Abstract: The aim of this study was to examine the association between type of dental visit and number of remaining teeth in Japanese elders. Data were collected from 3,163 adults aged 75 or 80 years who underwent an oral health examination. Type of dental visit was classified into four categories by treatment(s) received (none, periodontal, caries, or other treatment). Number of remaining teeth was classified as ≥20, 10-19, or 0-9 teeth. Multivariate multinomial logistic regression analysis was used to examine associations between type of dental visit and number of remaining teeth among all participants and the 3,032 dentate elderly. As compared with elders who did not visit a dentist, those who received periodontal or caries treatments had a significantly lower odds ratio for having 0-9 teeth, and those who received periodontal treatment had a significantly lower odds ratio of having 10-19 teeth. In the multivariate linear regression model, number of days of periodontal treatment was positively associated with number of remaining teeth. Our results suggest that type of dental visit is associated with number of remaining teeth in Japanese elders.

Keywords: aged; type of dental visit; number of teeth; tooth loss.

Introduction

Oral functions such as chewing, swallowing, and speaking are important in daily life. Thus, the tendency of elders to have decreased oral function is a serious health concern in aging societies. Many studies have reported associations between oral health status and systemic health issues (1-3). Individuals with 20 or more teeth had better chewing ability than did those with fewer than 20 teeth (4). Decreased chewing ability due to tooth loss also affects nutrition intake and can lead to malnutrition (5,6). Maintaining natural teeth is important in general health maintenance (7), as tooth loss is associated with depression, anxiety, and cognitive decline and can lead to decreased social functioning and social interaction. These health concerns decrease quality of life among elders and increase the need for nursing care. Thus, oral health is important in maintaining a healthy, satisfying life for elders. In Japan, the 8020 Movement promotes having 20 or more natural teeth at age 80 years and has been working since 1989 to extend healthy life expectancy by preserving natural teeth (8).

Regular dental visits help prevent tooth loss among elders (9-11). A study of factors related to tooth loss among elders found that low income, low educational level, and infrequent dental visits were associated with tooth loss (10). A study of Swedish elders reported that those who visited a dentist more than once per year tended to have more than 20 teeth (9). A 10-year retrospective study in Japan reported that regular dental visits were associated with a significantly lower risk of tooth extraction (11). Previous studies usually obtained information on the frequency of dental visits from self-
administered questionnaires completed by patients or study participants. Such data may be inaccurate, and the nature of dental treatments is often unclear. In this study, we used dental claims data to ascertain type of dental visit and type of dental treatment and examined associations of these variables with the number of remaining teeth in a sample of Japanese elders.

Materials and Methods

Study population
The study participants were adults insured by the Japan public health insurance system for elders aged ≥75 years. Recipients receive a general health examination annually. Since 2014, the government has subsidized an oral health examination for the aged population, and, in 2014, the insurer in Mie Prefecture began providing the examination to elders aged 75 or 80 years. This cross-sectional study examined the records of general and oral health examinations covered by the insurer for elders aged ≥75 years in Mie Prefecture.

In September 2014 the insurer for the aged population in Mie Prefecture sent a ticket for an oral health examination to adults aged 75 or 80 years. In 2014, there were 17,338 people aged 75 years and 16,040 people aged 80 years in Mie Prefecture. In total, 7,995 (46.1%) adults aged 75 years and 6,699 (41.8%) adults aged 80 years underwent general health examinations, and 2,865 (16.5%) and 2,119 (13.2%), respectively, underwent oral health examinations. The oral examinations were available from October 1 through November 30, 2014, at any dental clinic registered with the Mie Dental Association. Because the health examinations were not conducted for the survey but rather as periodic health checkups for the elderly population, we did not obtain consent from the participants. However, permission was obtained from the insurer to use de-identified data for this study. The study was approved by the Institutional Review Board of Aichi Gakuin University, School of Dentistry (approval number 443), and was conducted in full accordance with the World Medical Association Declaration of Helsinki. This study conforms to the STROBE guidelines for human observational studies.

Oral health examination
To standardize assessment of oral health status, dentists at each dental clinic used detailed manuals to conduct oral health examinations. The condition of each tooth was recorded as sound, decayed, filled, or missing, and number of remaining teeth was calculated as the total of sound, decayed, and filled teeth, after excluding third molars.

Medical examination
Fasting glucose or glycated hemoglobin (HbA1c) level, blood pressure, and body mass index (BMI) were measured during the medical examination. Height and body weight were measured to calculate the BMI of each participant. Diabetes was defined as a fasting plasma glucose level ≥126 mg/dL, an HbA1c (NGSP) level ≥6.5%, or use of antidiabetic medication. Hypertension was defined as a systolic blood pressure ≥140 mm Hg, a diastolic blood pressure ≥90 mm Hg, or use of antihypertensive medication. Overweight was defined as a BMI ≥25.

Interview
A self-administered questionnaire was used to collect information on participant oral health behavior, such as current smoking habit (yes or no); having a family dentist (yes or no); eating between meals (never, sometimes, or every day); toothbrushing before sleeping (never, sometimes, or every day); use of secondary oral hygiene products, such as dental floss or interdental brushes (never, sometimes, or every day); and chewing food well (never, sometimes, or every day).

Type of dental visit
Insurer dental claims data were used to determine type of dental visit. Dental procedures performed in fiscal 2014, according to dental claims data, were categorized as caries treatment, periodontal treatment, or other dental treatment. Type of dental visit was classified into four categories, based on the type of dental treatment(s), individually or in combination, as follows: no dental visit, periodontal treatment, caries treatment, and other dental treatment only. Participants who received both periodontal treatment and another dental treatment (caries or other) were classified as having undergone periodontal treatment. Participants who received both caries and other dental treatment were classified as having undergone caries treatment.

Statistical analysis
Data from 3,163 participants who had undergone dental and medical examinations and had no missing data were included in the analyses. Number of remaining teeth was classified as ≥20, 10-19, or 0-9. Differences in the means and proportions of categorical variables in relation to number of remaining teeth were evaluated with analysis of variance or the Pearson chi-square test. Bivariate and multivariate multinomial logistic regression analyses were used to examine associations of age, sex, smoking, chewing well, eating between meals, toothbrushing...
before sleep, use of secondary oral hygiene products, hypertension, overweight, diabetes, and type of dental visit with number of remaining teeth. Both unadjusted and covariate-adjusted odds ratios (ORs) and confidence intervals were calculated for number of remaining teeth. Variables that were statistically significant in bivariate analysis were used in the multivariate logistic regression analyses. In addition, we examined the association between type of dental visit and number of remaining teeth among the 3,023 dentate participants. Multiple linear regression analysis was used to examine the linear association between number of days receiving periodontal treatment during a year and number of remaining teeth. All statistical analyses were performed with SPSS

| Variable                          | No. of remaining teeth | P-value |
|-----------------------------------|------------------------|---------|
|                                   | ≥20 (n = 1,797)        | 10-19 (n = 788) | 0-9 (n = 578) |< 0.001 |
| No. of teeth                      | mean (SD)              | mean (SD) | mean (SD) |< 0.001 |
|                                   | 24.8 (2.5)             | 15.3 (2.9) | 4.4 (3.2) |< 0.001 |
| Age                               |                        |          |          |< 0.001 |
| 75 years                          | 1,209 (67.3)           | 418 (53.0) | 255 (44.1) |< 0.001 |
| 80 years                          | 588 (32.7)             | 370 (47.0) | 323 (55.9) |< 0.001 |
| Sex                               |                        |          |          |0.166   |
| male                              | 827 (46.0)             | 356 (45.2) | 240 (41.5) |0.166   |
| female                            | 970 (54.0)             | 432 (54.8) | 338 (58.5) |0.166   |
| Smoking habit                     |                        |          |          |< 0.001 |
| no                                | 1,743 (97.0)           | 759 (96.3) | 539 (93.3) |< 0.001 |
| yes                               | 54 (3.0)               | 29 (3.7)  | 39 (6.7)  |< 0.001 |
| Chewing well                      |                        |          |          |0.019   |
| never                             | 191 (10.6)             | 103 (13.1) | 86 (14.9) |0.019   |
| sometimes                         | 409 (22.8)             | 197 (25.0) | 138 (23.9) |0.019   |
| every day                         | 1,197 (66.6)           | 488 (61.9) | 354 (61.2) |0.019   |
| Eating between meals              |                        |          |          |0.075   |
| never                             | 242 (13.5)             | 109 (13.8) | 78 (13.5) |0.075   |
| sometimes                         | 1,189 (66.2)           | 493 (62.6) | 353 (61.1) |0.075   |
| every day                         | 366 (20.4)             | 186 (23.6) | 147 (25.4) |0.075   |
| Have a family dentist             |                        |          |          |0.018   |
| yes                               | 1,635 (91.0)           | 739 (93.8) | 519 (89.8) |0.018   |
| no                                | 162 (9.0)              | 49 (6.2)  | 59 (10.2) |0.018   |
| Toothbrushing before sleep        |                        |          |          |0.010   |
| every day                         | 1,438 (80.0)           | 605 (76.8) | 432 (73.2) |0.010   |
| sometimes                         | 203 (11.3)             | 101 (12.8) | 83 (14.4) |0.010   |
| never                             | 156 (8.7)              | 82 (10.4)  | 72 (12.5) |0.010   |
| Secondary oral hygiene products   |                        |          |          |< 0.001 |
| never                             | 665 (37.0)             | 351 (44.5) | 408 (70.6) |< 0.001 |
| sometimes                         | 485 (27.0)             | 187 (23.7) | 79 (13.7) |< 0.001 |
| every day                         | 647 (36.0)             | 250 (31.7) | 91 (15.7) |< 0.001 |
| Hypertension                      |                        |          |          |0.118   |
| no                                | 650 (36.2)             | 254 (32.2) | 193 (33.4) |0.118   |
| yes                               | 1,147 (63.8)           | 534 (67.8) | 385 (66.6) |0.118   |
| Diabetes                          |                        |          |          |0.009   |
| no                                | 1,619 (90.1)           | 682 (86.5) | 501 (86.7) |0.009   |
| yes                               | 178 (9.9)              | 106 (13.5) | 77 (13.3) |0.009   |
| Overweight                        |                        |          |          |0.052   |
| no                                | 1,454 (80.9)           | 605 (76.8) | 456 (78.9) |0.052   |
| yes                               | 343 (19.1)             | 183 (23.2) | 122 (21.1) |0.052   |
| Type of dental visit              |                        |          |          |< 0.001 |
| no dental visit                   | 102 (5.7)              | 67 (8.5)  | 160 (27.7) |< 0.001 |
| periodontal treatment             | 1,603 (89.2)           | 671 (85.2) | 318 (55.0) |< 0.001 |
| caries treatment                  | 65 (3.6)               | 26 (3.3)  | 21 (3.6)  |< 0.001 |
| other treatment only              | 27 (1.5)               | 24 (3.0)  | 79 (13.7) |< 0.001 |

SD: standard deviation.

Table 1 Characteristics of study participants in relation to number of remaining teeth
ver. 24.0 (IBM, Chicago, IL, USA). A P value of <0.05 was considered to indicate statistical significance.

**Results**

There were 1,797 (56.8%) elders with at least 20 teeth, 788 (24.9%) with 10-19 teeth, and 578 (18.3%) with 0-9 teeth. Table 1 shows the characteristics of the participants in relation to number of remaining teeth. Age, smoking habit, chewing well, having a family dentist, toothbrushing before sleep, use of secondary oral hygiene products, diabetes, and type of dental visit were significantly associated with number of remaining teeth.

Table 2 shows the associations of participant characteristics and number of teeth with type of dental visit.

Among elders with 0-9 teeth, the proportion of those who received periodontal treatment was higher for elders aged 75 years than for those aged 80 years.

Table 3 shows the associations of type of dental visit and other variables with number of remaining teeth. In multivariate analyses, age, sex, smoking habit, having a family dentist, use of secondary oral hygiene products, diabetes, and type of dental visit were significantly associated with number of remaining teeth. As compared with elders who did not visit a dentist, those who received periodontal treatment or caries treatment had a significantly lower OR for having 0-9 teeth, and those who received periodontal treatment had a significantly lower OR for having 10-19 teeth. In contrast, elders who received other treatment had a significantly higher OR of having 0-9 teeth. Elders using secondary oral hygiene products had a significantly lower OR for having 0-9 or 10-19 teeth, and those with a smoking habit had a significantly higher OR for having 0-9 teeth. Elders who did not have a family dentist had a significantly lower OR for 10-19 or 0-9 teeth, as compared with those who had a family dentist.

Table 4 shows the association between type of dental treatment and number of remaining teeth among dentate elders. Elders who received periodontal treatment or caries treatment had a significantly lower OR for having 1-9 teeth than did those who did not visit a dentist, and those who received periodontal treatment had a significantly lower OR for having 10-19 teeth.

Table 5 shows the results of multiple linear regression analysis of the association between number of days receiving periodontal treatment during a year and number of remaining teeth. Number of days receiving periodontal treatment was positively associated with number of remaining teeth ($P < 0.001$).

**Discussion**

Elders who visited a dental clinic to receive treatment for periodontal disease or dental caries tended to have more teeth than did those who did not seek dental treatment.
during the fiscal year of examination. Thus, visiting a dental clinic appears to be associated with tooth retention.

Several studies have examined the relationship between dental visits and tooth loss. Middle-aged Swedes who visited a dentist regularly at baseline and follow-up had a significantly lower risk of tooth loss (12). A study of Swedish elders found that regular dental visits were associated with tooth retention (9). Similarly, dental visits were associated with tooth retention in Japanese elders: individuals who visited a dentist during the fiscal year of examination had a significantly lower risk of having fewer teeth. A follow-up study of young people

| Variable                      | Dependent variable: no. of remaining teeth | 10-19 vs. ≥20 teeth | 0-9 vs. ≥20 teeth |
|-------------------------------|--------------------------------------------|--------------------|------------------|
|                              | crude OR (95% CI)                          | adjusted OR (95% CI) | crude OR (95% CI) | adjusted OR (95% CI) |
| Age                           |                                            |                    |                  |
| 75 years                      | 1                                          | 1                  | 1                |
| 80 years                      | 1.82 (1.53-2.16)**                         | 1.82 (1.53-2.17)** | 2.60 (2.15-3.15)** | 2.24 (1.82-2.77)** |
| Sex                           |                                            |                    |                  |
| male                          | 1                                          | 1                  | 1                |
| female                        | 1.04 (0.87-1.22)                           | 1.15 (0.96-1.37)   | 1.20 (0.99-1.45) | 1.58 (1.26-1.97)** |
| Smoking habit                 |                                            |                    |                  |
| no                            | 1                                          | 1                  | 1                |
| yes                           | 1.23 (0.78-1.95)                           | 1.25 (0.78-2.01)   | 2.34 (1.53-3.57)**| 2.14 (1.31-3.50)** |
| Chewing well                  |                                            |                    |                  |
| never                         | 1                                          | 1                  | 1                |
| sometimes                     | 0.89 (0.67-1.20)                           | 0.91 (0.67-1.22)   | 0.75 (0.54-1.03) | 0.78 (0.55-1.11) |
| Every day                     | 0.76 (0.58-0.98)*                          | 0.78 (0.59-1.02)   | 0.66 (0.50-0.87)**| 0.75 (0.55-1.03) |
| Have a family dentist         |                                            |                    |                  |
| yes                           | 1                                          | 1                  | 1                |
| no                            | 0.67 (0.48-0.93)*                          | 0.57 (0.41-0.80)** | 1.15 (0.84-1.57) | 0.70 (0.49-1.00)* |
| Toothbrushing before sleep    |                                            |                    |                  |
| every day                     | 1                                          | 1                  | 1                |
| sometimes                     | 1.18 (0.95-1.53)                           | 1.11 (0.85-1.45)   | 1.39 (1.05-1.83)*| 1.07 (0.78-1.47) |
| Secondary oral hygiene products|                                            |                    |                  |
| never                         | 1                                          | 1                  | 1                |
| sometimes                     | 0.73 (0.59-0.90)**                         | 0.76 (0.61-0.95)* | 0.27 (0.20-0.35)**| 0.34 (0.25-0.45)** |
| every day                     | 0.73 (0.60-0.89)**                         | 0.80 (0.65-0.99)* | 0.23 (0.18-0.30)**| 0.32 (0.24-0.42)** |
| Diabetes                      |                                            |                    |                  |
| no                            | 1                                          | 1                  | 1                |
| yes                           | 1.41 (1.09-1.83)**                         | 1.38 (1.06-1.79)* | 1.40 (1.05-1.86)*| 1.29 (0.94-1.78) |
| Type of dental visit          |                                            |                    |                  |
| no dental visit               | 1                                          | 1                  | 1                |
| periodontal treatment         | 0.64 (0.46-0.88)*                          | 0.70 (0.50-0.98)* | 0.13 (0.10-0.17)**| 0.17 (0.13-0.23)** |
| caries treatment              | 0.61 (0.35-1.06)                           | 0.62 (0.36-1.09)   | 0.21 (0.12-0.36)**| 0.22 (0.12-0.39)** |
| other treatment only          | 1.35 (0.72-2.54)                           | 1.25 (0.66-2.37)   | 1.87 (1.13-3.08)* | 1.71 (1.01-2.89)* |

| Variable                      | Dependent variable: no. of remaining teeth | 10-19 vs. ≥20 teeth | 1-9 vs. ≥20 teeth |
|-------------------------------|--------------------------------------------|--------------------|------------------|
|                              | crude OR (95% CI)                          | adjusted OR (95% CI) | crude OR (95% CI) | adjusted OR (95% CI) |
| Type of dental visit          |                                            |                    |                  |
| no dental visit               | 1                                          | 1                  | 1                |
| periodontal treatment         | 0.64 (0.46-0.88)*                          | 0.71 (0.51-0.98)* | 0.23 (0.17-0.31)**| 0.29 (0.21-0.40)** |
| caries treatment              | 0.61 (0.35-1.01)                           | 0.63 (0.36-1.10)   | 0.35 (0.20-0.63)**| 0.37 (0.20-0.68)** |
| other treatment only          | 1.35 (0.72-2.54)                           | 1.28 (0.67-2.42)   | 1.87 (1.06-3.28)* | 1.70 (0.94-3.05) |

Table 3 Association of type of dental visit and other variables with number of remaining teeth

Table 4 Association between type of dental visit and number of remaining teeth among dentate elders

n = 3,163. OR: odds ratio, CI: confidence interval.
*: P < 0.05, **: P < 0.01.
reported that regular dental visits, oral hygiene habits such as dental floss use, and frequency of toothbrushing during childhood were associated with periodontal health in adulthood (13). To retain as many natural teeth as possible until old age, good oral hygiene habits should be encouraged among children.

Dental caries and periodontal disease are the main causes of tooth loss (14); thus, prevention of caries and periodontal disease contributes to tooth retention. In addition, early treatment of caries and periodontal disease prevents tooth loss. A previous study reported that people who visited a dentist regularly had a significantly lower caries incidence, fewer missing teeth, and fewer decayed teeth (15). Regular dental visits likely resulted in early detection of caries and suppression of caries progression. In the present study, individuals who received periodontal treatment had a significantly lower risk of having 10-19 or 0-9 teeth. In addition, number of days receiving periodontal treatment was correlated with number of remaining teeth. Periodontal treatment is likely to include dental visits for regular maintenance. In a previous study, individuals who regularly visited the dentist had a lower prevalence of periodontal disease (16). Because the risk of tooth loss due to periodontal disease is higher among elders (14), it is important to maintain healthy periodontal tissue. Regular dental visits to maintain oral health and receive treatment for caries and periodontal disease prevent tooth loss.

In this study, visiting a dental clinic for reasons other than dental caries or periodontal disease only was significantly associated with having 0-9 teeth, but there was no significant association between visiting a dentist for other treatment only and number of teeth in the analysis excluding edentulous participants. Edentulous elders do not need caries or periodontal treatment and therefore might visit dentists less frequently than dentate elders do. Thus, dental visits for edentulous participants seeking prosthetic treatment might have affected our results. As this was a cross-sectional study, the chronological relationship between dental visit and tooth loss is unknown. In this study, the risk of having fewer than 20 teeth was lower for elders without a family dentist than for those with a family dentist, probably because participants with poor oral health were more likely to need a family dentist. However, cross-sectional studies cannot reveal causal relationships. A longitudinal study will be necessary in order to clarify the relationship between reason for dental visit and number of remaining teeth.

In this study, use of secondary oral hygiene products and smoking habit were significantly associated with number of remaining teeth, independent of type of dental visit. Secondary oral hygiene products such as interdental brushes and dental floss are highly effective for removing dental plaque and can prevent caries and periodontal disease (17). As smoking is a major risk factor for periodontal disease (18), periodontal deterioration due to smoking may lead to tooth loss. Oral health guidance, including education regarding smoking cessation and use of secondary oral hygiene products, is important for preventing tooth loss. Visitors to dental clinics are able to obtain information and learn about oral health, particularly with regard to issues relevant to their own oral status (19). In addition, providing oral health guidance to elders who cannot visit a dentist may improve the oral health of this population.

Several limitations of this study should be mentioned. Because the study used cross-sectional data, it is not possible to verify causal relationships between type of dental visit and tooth loss. Oral examinations were performed on the basis of detailed manuals but were not standardized by calibration among dentists. We were unable to adjust for socioeconomic confounders such as educational level, household income, and family history because the relevant data were not available. The participants in this study voluntarily underwent health examinations; thus, they probably had a greater interest in their own health as compared with those who did not voluntarily undergo such examinations, as they were sufficiently proactive to arrange for the checkups. Therefore, the variables of interest might differ between individuals who did and did not undergo health examinations, and it is difficult to generalize the results.

In conclusion, data from health examinations of Japanese elders suggest that type of dental visit is associated

### Table 5 Association between days of periodontal treatment and number of remaining teeth

| Variable          | Dependent value: no. of remaining teeth |
|-------------------|----------------------------------------|
| Periodontal treatment days/year | 0.11 (0.07, 0.16) | <0.001 |

*Adjusted for age, sex, smoking habit, chewing well, have a family dentist, toothbrushing before sleep, use of secondary oral hygiene products, and diabetes. R² = 0.117.
with number of remaining teeth. Dental visits may help prevent tooth loss, and promotion of regular dental visits might help maintain oral health in elders. Future studies should examine the underlying causal relationships for these findings.

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**Conflict of interest**

The authors declare that they have no competing interests.

**References**

1. Patel MH, Kumar JV, Moss ME (2013) Diabetes and tooth loss: an analysis of data from the National Health and Nutrition Examination Survey, 2003-2004. J Am Dent Assoc 144, 478-485.
2. Nilsson H, Berglund J, Renvert S (2014) Tooth loss and cognitive functions among older adults. Acta Odontol Scand 72, 639-644.
3. Okamoto N, Morikawa M, Yanagi M, Amano N, Tomioka K, Hazaki K et al. (2015) Association of tooth loss with development of swallowing problems in community-dwelling independent elderly population: the Fujiwara-kyo study. J Gerontol A Biol Sci Med Sci 70, 1548-1554.
4. Tatematsu M, Mori T, Kawaguchi T, Takeuchi K, Hattori M, Morita I et al. (2004) Masticatory performance in 80-year-old individuals. Gerodontology 21, 112-119.
5. Shimazaki Y, Soh I, Saito T, Yamashita Y, Koga T, Miyazaki H et al. (2001) Influence of dentition status on physical disability, mental impairment, and mortality in institutionalized elderly people. J Dent Res 80, 340-345.
6. Perera R, Ekanayake L (2012) Relationship between nutritional status and tooth loss in an older population from Sri Lanka. Gerodontology 29, e566-570.
7. Morita I, Nakagaki H, Kato K, Murakami T, Tsuboi S, Hayashizaki J et al. (2006) Relationship between survival rates and numbers of natural teeth in an elderly Japanese population. Gerodontology 23, 214-218.
8. Shinsho F (2001) New strategy for better geriatric oral health in Japan: 80/20 movement and Healthy Japan 21. Int Dent J 51, 200-206.
9. Renvert S, Persson RE, Persson GR (2011) A history of frequent dental care reduces the risk of tooth loss but not periodontitis in older subjects. Swed Dent J 35, 69-75.
10. Buchwald S, Kocher T, Biffar R, Harb A, Holtfreter B, Meisel P (2013) Tooth loss and periodontitis by socio-economic status and inflammation in a longitudinal population-based study. J Clin Periodontol 40, 203-211.
11. Yoshino K, Ito K, Kuroda M, Sugihara N (2016) Tooth loss in problem-oriented, irregular, and regular attenders at dental offices. Bull Tokyo Dent Coll 57, 11-19.
12. Astrom AN, Ekback G, Ordell S, Nasir E (2014) Long-term routine dental attendance: influence on tooth loss and oral health-related quality of life in Swedish older adults. Community Dent Oral Epidemiol 42, 460-469.
13. Lissau I, Holst D, Friis-Hasche E (1990) Dental health behaviors and periodontal disease indicators in Danish youths. A 10-year epidemiological follow-up. J Clin Periodontol 17, 42-47.
14. Aida I, Ando Y, Akhter R, Aoyama H, Masui M, Morita M (2006) Reasons for permanent tooth extractions in Japan. J Epidemiol 16, 214-219.
15. Aldossary A, Harrison VE, Bernabé E (2015) Long-term patterns of dental attendance and caries experience among British adults: a retrospective analysis. Eur J Oral Sci 123, 39-45.
16. Karimalakuzhiyil Ali Kutty F, Bernabé E (2016) Long-term regular dental attendance and periodontal disease in the 1998 adult dental health survey. J Clin Periodontol 43, 114-120.
17. Sälzer S, Slot DE, Van der Weijden FA, Dörfer CE (2015) Efficacy of inter-dental mechanical plaque control in managing gingivitis--a meta-review. J Clin Periodontol 42, S92-105.
18. Genco RJ, Borgnakke WS (2013) Risk factors for periodontal disease. Periodontol 2000 62, 59-94.
19. Gilbert GH, Stoller EP, Duncan RP, Earls JL, Campbell AM (2000) Dental self-care among dentate adults: contrasting problem-oriented dental attenders and regular dental attenders. Spec Care Dentist 20, 155-163.