

Original Article

Percentile Curves for Present Teeth in Smokers and Non-smokers in an Adult Male Population

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Abstract

The purpose of this study was to obtain percentile curves for present teeth in smokers and non-smokers for use in oral health education. Dental examinations were carried out by two dentists. The number of present teeth in each subject was counted, excluding the third molars. Subjects consisted of 2,283 men aged between 25 and 54 years enrolled in the health insurance union of a bank in Yokohama, Japan. Each subject completed a questionnaire on smoking habits and number of cigarettes smoked. They were classified into two groups: smokers and non-smokers. The mean number of present teeth in both groups was compared with the Mann-Whitney's U test. Smokers had fewer teeth than non-smokers in all age groups ($p < 0.05$). At the age of 50, the 50th percentile for present teeth was 26 for smokers and 27 for non-smokers. However, the 3rd percentile for smokers' present teeth was 20.5 at 40 years of age and 14 at 50 years of age, while for non-smokers it was 22.5 at 40 years of age and 19 at 50 years of age. The 3rd percentile curve for smokers' present teeth decreased in those aged 45 years and over. The percentile curves in this analysis showed a clear difference between the two groups. These data should be made available for use in adult oral health education.

Key words: Percentile curves—Present teeth—Smokers—Adult population—Oral health education

Introduction

The child growth charts using percentile curves for height and weight described by Tanner *et al.*²⁴⁾ and also by the National Center For Health Statistics (NCHS)^{13,14)} have commonly been used by many countries as an ancillary tool for screening children with nutritional disorders. The value of physical growth data depends on their accuracy and

reliability, and how they are recorded and interpreted, and what follow-up efforts are made after growth normalities and abnormalities are identified. In their analysis, Cole⁹⁾ discussed statistical smoothing procedures in detail based on the LMS method (L: smooth curve, M: mean, and S: coefficient of variation).

In the field of dental health, Osada *et al.*²⁰⁾ reported numbers of present teeth using percentile curves in 1990. The purpose of

percentile curve indicators is for individual clients and patients to be able to visibly recognize and understand their own oral health status by comparing them with the percentile curve indicators produced from general populations. Osada introduced smoothed percentile curves for present teeth in 1999²¹⁾. They estimated percentile curves and values on the basis of the distribution of numbers of missing teeth in 5,036 subjects aged 40–79 years. Primary data on subjects' missing teeth was based on the National Report on the Survey of Dental Disease in 1987.

In our previous study²⁵⁾, we reported percentile curves for present and sound teeth used as an evaluation tool in oral health instruction for office workers. Subjects consisted of 3,195 men aged between 23 and 64 years and 1,909 women aged between 20 and 49 years. The trajectory of the 75th percentile curve for male and female present teeth in that survey was similar to that of the 50th percentile curve of a survey conducted by the Tokyo metropolitan government (Oral Health Status of Adult Population in Tokyo). The percentile curves for teeth are not only useful indicators in assessing a population, but may also be used in oral health instruction for office workers.

Recently many studies have reported that smoking is in itself a risk factor for periodontal disease, even when oral hygiene is good^{1,4,11)}. A clear relationship between smoking and periodontal disease has been shown, and tobacco smoking has been shown to be a major risk factor for tooth loss^{1,4,6,11,22)}.

The purpose of this study was to provide the percentile curves for present teeth in smokers and non-smokers for use in oral health education.

Materials and Methods

Dental examinations were carried out by two dentists in 2000. The diagnostic criteria of this study were set according to the National Report on the Survey of Dental Disease of 1999¹⁰⁾. The proportion of participation in this study was 76.2% of the membership of

the health insurance union of a bank in Japan. The subjects analyzed in this study consisted of 2,283 men aged between 25 and 54 years. Many women also volunteered to receive regular dental examinations, but almost all of them were under 40 years of age and had few missing teeth. Therefore, women were excluded in this study. Each subject completed a questionnaire on smoking habits and number of cigarettes smoked. Subjects were then further evaluated at regular health examinations in 1999. They were divided into non-smokers, former smokers, and current smokers at that time. For this study, the subjects were classified into two groups, smokers and non-smokers. Former smokers were classified as non-smokers. To compare mean number of present teeth in smokers and non-smokers, they were also divided into three age groups by age: 25–34 years, 35–44 years, and 45–54 years.

1. Setting of number of teeth (present number of teeth) from acquired data

Completely and partially erupted permanent teeth and fused teeth were counted as one tooth. In addition, supernumerary teeth and the pontic of the bridge prosthesis and implant-supported superstructures were excluded from the data. In this study, we also excluded the third molars.

2. Determining percentile value

The percentile value was calculated in accordance with the method of Osada²¹⁾ as described below. Number of teeth and cumulative relative frequency at each age is shown in Fig. 1. For instance, when we calculated the 50th percentile value, in the case of $R(K) < 50 < R(K+1)$, the number of present teeth corresponding to the 50th percentile was between K teeth and $K+1$ teeth. However, if we calculated the percentile value for the person with K teeth from number of teeth alone, it was difficult to reach a specific value, as there was a distribution from $R(K)\%$ to the $R(K+1)\%$.

The percentile values for the number of teeth were therefore determined by the corre-

sponding values of each cumulative relative frequency from 0 teeth to 28 teeth at each age.

When X (cumulative relative frequency) existed between the numbers K and K + 1, the percentile value P(X) was obtained by the following expression:

$$P(X) = K + \{X - R(K)\} / \{R(K + 1) - R(K)\}$$

3. Curve smoothing

The resulting lines connecting the percentile points plotted on the graph were jagged

or irregular, partly due to sampling variations. Therefore, statistical smoothing procedures were applied to the observed data to generate smoothed curves for selected percentiles and to generate parameters that could be used to produce additional percentiles. The percentile curves were plotted with Excel Ver. 2000 (Microsoft Ltd, Chicago, IL, USA) and the moving average method was used for smoothing.

4. Statistical methods

The significance of the difference in the mean present teeth of smokers and non-smokers was assessed with the Mann-Whitney's U test.

Results

Table 1 lists the mean numbers of present teeth in smokers and non-smokers. In the 25–34-year age group, it was 27.5 for smokers and 27.6 (p<0.05) for non-smokers. In the 35–44-year age group, it was 26.4 for smokers and 27.0 (p<0.05) for non-smokers. In the 45–54-year age group, it was 25.5 for smokers and 26.2 (p<0.05) for non-smokers.

Figure 2 shows the percentile curves for present teeth in smokers and non-smokers. The 50th percentile for smokers was 27 at 40 years of age and 26 at 50 years, and that of non-smokers was 27 at 50 years. The 10th percentile for smokers was 23 at 40 years of age and 20 at 50 years, while that of non-smokers

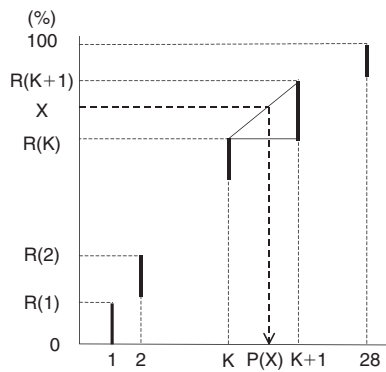


Fig. 1 Percentile value {P(X)} of present teeth calculated by cumulative relative frequency

- 1) Horizontal axis: Present teeth (0–28)
Vertical axis: Cumulative relative frequency
- 2) Bold lines represent the distribution of present teeth
- 3) P(X): Percentile value of cumulative relative frequency (X)
- 4) R(K): Cumulative relative frequency of K teeth
- 5) $R(K) < X < R(K + 1)$: K is integer number
 $P(X) = K + \{X - R(K)\} / \{R(K + 1) - R(K)\}$

Table 1 Mean numbers of present teeth for smokers and non-smokers

Age group		n	Mean numbers of present teeth	S.D.	Mann-Whitney's U test
25–34	Smokers	420	27.5	1.0	<0.05
	Non-smokers	433	27.6	0.9	
35–44	Smokers	425	26.4	2.2	<0.05
	Non-smokers	445	27.0	1.9	
45–54	Smokers	272	25.5	3.7	<0.05
	Non-smokers	288	26.2	2.5	

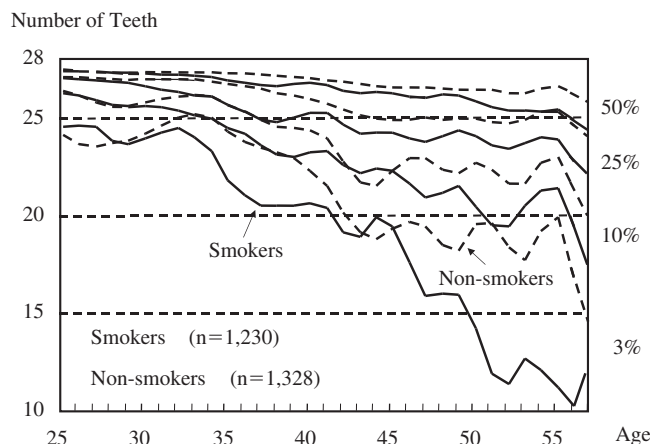


Fig. 2 Percentile curves for present teeth in adult population for smokers and non-smokers

was 22 at 50 years. The 3rd percentile for smokers was 20.5 at 40 years of age and 14 at 50 years, while that for non-smokers was 23 at 40 years and 19 at 50 years. The 3rd percentile curves for smokers decreased in those over 45 years of age.

Discussion

In this study, we found that smokers had fewer present teeth than non-smokers in all age groups. This finding agrees with those of several earlier studies^{1-4,6,8,11,15,16,22,23}. From cross-sectional epidemiological observations, Bergström⁶ found that subjects with lifelong exposure to smoking had on average lost a greater number of teeth compared with subjects with low exposure to smoking. In a survey on edentulousness, Österberg *et al.*²² found that toothlessness in men was more common in smokers, at 48%, and ex-smokers, at 32%, than in non-smokers, at 20%.

Recently, Linden *et al.*¹⁶ reported that smokers had lost more teeth than non-smokers from 82 regular dental patients aged between 20 and 33 years. Furthermore, Söder *et al.*²³ found that smokers had significantly higher mean scores than non-smokers for number of missing teeth ($p < 0.05$) in 144 subjects aged 31–40 years. In this respect,

Axelsson *et al.*³ concluded that smoking was a significant risk indicator for tooth loss.

In a longitudinal epidemiological study, Ahlqvist *et al.*¹ found that women smokers aged 38–60 years had significantly fewer remaining teeth than non-smokers in the same age group. Holm¹⁵ reported that the relative risk of losing teeth was greatest for the young age group (<50) who smoked more than 15 cigarettes a day compared to those who did not smoke. Chen *et al.*⁸ also found that there was greater tooth loss in smokers than in non-smokers ($p < 0.01$) in their 10-year longitudinal study.

Recently, many reports have been published on the effects of smoking, which include deeper probing depth¹², greater attachment loss^{6,17-19}, and alveolar bone loss^{5,7}. There is a clear necessity to facilitate patient understanding of the difference between smokers and non-smokers in terms of tooth loss.

Although the reasons for such tooth loss remain unclear, the percentile curves obtained in this study based on data derived from smokers and non-smokers revealed clear differences between the two groups. The percentile curves in this study should be made available for use in adult oral health education.

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