

Periodontal bone height in professional musicians. Cross-sectional and longitudinal aspects

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Cross-sectional and longitudinal studies of the periodontal bone height were performed on professional musicians playing wind and non-wind instruments. The cross-sectional study population included 244 occupational musicians (186 men and 58 women aged 20–69 years) from three Swedish national orchestras. Eighty-seven were wind instrument musicians. Radiographic full-mouth surveys were performed and the periodontal bone height was measured with a computerized method and expressed as a percentage of the root length. The mean periodontal bone height was 83.4% for the musicians playing wind instruments and 83.6% for those playing non-wind instruments. There was no statistically significant difference in periodontal bone height between the two instrumentalist categories. In addition, the bone height quotients of anterior to posterior teeth were analyzed but no significant differences were found between wind and non-wind instrumentalists. A longitudinal cohort including 92 musicians who had been examined in a corresponding study 10 years earlier was studied. The overall loss of the periodontal bone height over the 10-year period was small, but only wind instrumentalists of the 50–69 year age group exhibited a statistically significant reduction over time. There was no statistically significant difference between musicians as regards instrument played. It is concluded from the cross-sectional and 10-year longitudinal observations that the playing of wind instruments is unlikely to affect periodontal bone height. □ *Dental; periodontal bone height; radiography; root length; radiography; tooth length*

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Current knowledge indicates an improvement in periodontal health in the adult Swedish population during recent decades (1, 2). The number of remaining teeth has increased and the loss of periodontal bone height has decreased (3). Clinical and radiographic studies in subjects provided with regular dental care habits, including preventive measures, indicate a limited bone loss over time, irrespective of age (4–7).

The playing of wind instruments has been suggested as being a risk factor for periodontal disease (for a review, see Kilpinen (8)). In a study focused on professional musicians playing wind and non-wind instruments, periodontal health in terms of number of remaining teeth and periodontal bone height were of a high standard, and no significant differences between musicians playing different instruments could be established (9). Longitudinal studies, however, are needed in order to test the hypothesis that playing wind instruments is a risk factor for periodontal bone height reduction.

The purpose of the present study was therefore to examine the periodontal bone height in occupational musicians playing wind and those playing non-wind instruments, and to longitudinally study changes in periodontal bone height over a 10-year period in the two categories of musicians.

Materials and methods

Subjects

All full-time musicians in the Royal Orchestra, the

Swedish Radio Symphony Orchestra, and the Philharmonic Orchestra in Stockholm were invited to take part in the study. Out of 318 musicians invited, a total of 244 appeared for clinical and radiographic examination. The study population included 58 females and 186 males in the age range 20–69 years; 87 of them were wind instrument musicians (Table 1). The investigation was carried out between September 1992 and February 1993.

Of the 74 subjects who did not appear for radiographic examination, 13 accepted only clinical examination and 20 did not wish to participate but gave consent to examination of their dental records provided by their own dentist. Available clinical data and radiographs were collected and reviewed. These data were not included in the study, but there seemed to be little evidence of any crucial difference between these individuals and those taking part. The remaining 41 subjects (12 wind instrumentalists and 29 non-wind instrumentalists) could not be reached or did not consent to any examination of their dental records.

Ninety-two subjects (11 females and 81 males) had participated in a previous study in 1982 (baseline). These subjects, 41 wind instrumentalists and 51 non-wind instrumentalists, constitute the longitudinal cohort (Table 2), which included only approximately 40% of individuals examined at baseline. This was not primarily due to self-selection but to factors not related to the study, such as occupational reasons. Less than 2% of individuals elective for follow-up declined participation. Due to the limited number of subjects, the longitudinal cohort was subdivided

Table 1. The total population by age and gender

Age	Wind instrumentalists		Non-wind instrumentalists		Total	
	Female	Male	Female	Male	Female	Male
20–29	4	10	9	11	13	21
30–39	5	24	21	31	26	55
40–49	0	14	11	29	11	43
50–59	0	20	4	24	40	44
60–69	0	10	4	13	4	23
Total	9	78	49	108	58	186

Table 2. The longitudinal cohort by age in 1992 and gender

Age	Wind instrumentalists	Non-wind instrumentalists
30–49	15	25
50–69	26	26
Total	41	51

into 2 age-specific subgroups, 30–49 years and 50–69 years.

Clinical examination.—The amount of dental plaque was evaluated in accordance with the criteria of Silness & Loe (10). The buccal, distal, lingual, and mesial surfaces of all teeth were scored and the mean of all scores formed the plaque index of the individual (PLI). The inflammatory condition of the gingiva was evaluated using the gingival index (GI) method of Loe & Silness (11). The buccal, mesial, lingual, and distal sites of all teeth were scored and the mean of all scores formed the GI of the individual. The clinical assessment of plaque and gingival inflammation was performed by the same examiner (J.B.) in 1982 as in 1992.

Radiographic examination.—A full-mouth intraoral survey was performed for all subjects, including 16 periapical radiographs: 4 posterior and 5 anterior in the upper jaw and 4 posterior and 3 anterior in the lower jaw. A modified paralleling and long-distance technique was used. The films used were placed as parallel as possible to the longitudinal axis of the teeth, and were held in place by means of cellular-plastic film-holders. The X-ray equipment used, operating at 65–72 kVp, had a rectangular tube (Rinn) giving at least 20 cm focal spot-to-skin distance. The films used were Kodak Ekta Speed (speed group E). All subjects were examined at the Department of Oral Radiology, School of Dentistry, in Stockholm by specially trained assistants under the supervision of one of the authors (S.E.). The subsample was examined correspondingly in 1982. The investigation was approved by the local ethics committee of the Karolinska Institute.

Evaluation technology.—The proximal periodontal bone height was determined from the radiographs by means

of a graphic data system. In 1982 the system comprised a computer, a digitized graphic tablet (Tektronix 4953) with a cursor, and a graphic screen terminal (9). In 1992 the system was modified and developed and comprised a digitizing pad (Houston Instruments / Bausch & Lomb) with a cursor equipped with a magnifying lens ($\times 2.5$). The size of the active writing area of the tablet/pad was 280×280 mm and, according to the manufacturers, resolution was 0.125 mm. The radiographs were magnified 5-fold in a slide projector and projected onto the graphic tablet. The longitudinal axis of the tooth was oriented along one axis in the co-ordinate system on the graphic tablet.

Measurement procedure.—The proximal periodontal bone height was evaluated mesially and distally to each tooth, 3rd molars excluded, and expressed as a percentage of the length of the root. For single-rooted teeth, the length of the root was defined as the mean of the mesial and distal distances from the cemento-enamel junction to the dental apex. In multi-rooted teeth, root length was defined as the distance from the cemento-enamel junction to the apex and determined on the distal aspect of the distal root and on the mesial aspect of the mesial root. Measurements were made on facial roots. The height of the periodontal bone was determined as the distance from the apex to a point where the lamina dura became continuous with the compact bone of the interdental septum. If the periodontal space was widened, the height was determined at the level where the width of the periodontal space did not exceed 1 mm.

When no dental or bony landmark could be identified, due to restoration or overlapping for example, the tooth was excluded. Altogether, 17% of the teeth were excluded with a higher percentage for the maxillary teeth. A mean periodontal bone height was calculated for each subject on the basis of all mesial and distal readings. Furthermore, means were calculated for maxillary and mandibular incisors, premolars, and molars, respectively. The relationships between these were studied by means of the quotients of incisors to molars, incisors to premolars, and premolars to molars. As the number of teeth remaining was high, no consideration was made as to lost teeth in the longitudinal study. At the time of registration, no information was available concerning the instruments played.

Table 3. Number of remaining teeth, plaque index, and gingival index for the total population. Mean and SD by age in wind and non-wind instrumentalists

Age (years)	Remaining teeth				GI				PLI			
	Wind		Non-wind		Wind		Non-wind		Wind		Non-wind	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
20–29	27.8	0.39	27.5	1.01	0.73	0.40	0.70	0.45	0.84	0.29	0.93	0.47
30–39	27.6	1.02	27.5	1.05	0.64	0.34	0.58	0.37	0.77	0.35	0.72	0.41
40–49	27.8	0.42	26.8	1.83	0.88	0.39	0.87	0.39	0.74	0.32	0.78	0.41
50–59	26.0	2.14	26.5	1.95	0.84	0.44	1.04	0.56	0.69	0.31	0.87	0.30
60–69	24.5	3.53	25.3	2.19	0.90	0.53	0.93	0.34	0.73	0.47	0.76	0.38
Total	26.9	1.37	26.9	1.53	0.77	0.40	0.79	0.42	0.75	0.34	0.79	0.39

Table 4. Periodontal bone height, expressed as a percentage of the length of the root, for the total population. Mean and SD by age and instrument played

Age (years)	Wind instrumentalists		Non-wind instrumentalists		Total	
	Mean	SD	Mean	SD	Mean	SD
20–29	86.2	1.89	86.5	1.57	86.4	1.69
30–39	86.6	1.57	86.7	1.85	86.7	1.79
40–49	84.2	3.60	82.6	5.33	83.0	4.96
50–59	80.5	6.33	80.2	5.86	80.3	6.00
60–69	77.1	4.52	77.1	6.57	77.1	5.87
Total	83.6	3.38	83.4	3.92	83.5	5.22

Statistics.—The statistical significance of the differences between means was tested using Student's *t* test or, for longitudinal data, repeated measures ANOVA. Variables with a non-normal distribution were tested according to the Kolmogorov Smirnov test or for longitudinal data, repeated measures ANOVA on ranks (Kruskal-Wallis). Significance was accepted at the level $p < 0.05$.

Reproducibility.—The error of the computerized method used for the bone height measurements (random error) was estimated by duplicate measurements in 20 randomly selected subjects. The measurements were repeated after an interval of at least 1 day. A mean based on all measurements was established for each subject. The random error of the measurement procedure was calculated by means of the formula

$$s = \sqrt{\frac{\sum d_i^2}{2n}}$$

where d_i is the difference between the two mean values and n the number of differences. The error of the method was $s = \pm 0.6\%$. This random error value is in agreement with the previous estimation performed in 1982. The systematic errors at measurements on radiographs exposed in 1982 and 1992 have been studied earlier (7).

Gender differences.—A mean periodontal bone height of the female subjects was calculated and compared with that of

an age-matched male subsample. The difference between the means was not statistically significant and the conclusion drawn was that the periodontal bone height was not gender-dependent. All the subjects were therefore included in the analysis of data, irrespective of gender.

Results

Cross-sectional cohort

The number of remaining teeth, plaque index, and gingival index according to age are presented in Table 3. There were no statistically significant differences between wind and non-wind instrumentalists. The mean periodontal bone height in wind and non-wind instrument musicians according to age is presented in Table 4. The means were 83.6% and 83.4% in wind and non-wind instrumentalists, respectively. The difference between wind instrumentalists and non-wind instrumentalists was not statistically significant for the total population, nor for the age-specific subgroups.

The bone height quotients of incisors to premolars, incisors to molars, and premolars to molars are presented in Table 5. Throughout, the quotients were near unity, indicating negligible variations in periodontal bone height for various groups of teeth. There were no statistically significant differences between wind and non-wind

Table 5. Periodontal bone height. Quotients of incisors to premolars, incisors to molars, and premolars to molars for the maxilla and the mandible. Mean and SD by instrument played (total population). *n* = no. of subjects

Quotient	Wind instrumentalists			Non-wind instrumentalists			
	<i>n</i>	Mean	SD	<i>n</i>	Mean	SD	
Maxilla	incisors/premolars	73	1.00	0.05	138	0.99	0.05
	incisors/molars	78	1.08	0.07	137	1.07	0.09
	premolars/molars	74	1.06	0.14	138	1.08	0.12
Mandible	incisors/premolars	83	0.95	0.05	150	0.94	0.06
	incisors/molars	79	0.97	0.06	145	0.96	0.06
	premolars/molars	80	1.01	0.04	144	1.02	0.04

Table 6. Longitudinal cohort; no. of remaining teeth at baseline (1982), and 10-year follow-up (1992). Mean and SD by age and instrument played

Age (years)	Wind instrumentalists						Non-wind instrumentalists					
	1982		1992		Difference		1982		1992		Difference	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
30–49	27.2	1.24	27.2	1.10	0.00	0.54	26.8	1.58	26.8	1.42	0.00	0.55
50–69	26.1	2.08	25.2	3.05	0.88	1.70	26.5	2.25	26.0	2.39	0.52	1.22
Total	26.5	1.88	26.0	2.69	0.56	1.45	26.6	1.95	26.4	2.02	0.19	1.01

instrumentalists for the total population nor within age-specific subgroups.

Longitudinal cohort

The numbers of teeth remaining for the longitudinal cohort at baseline and 10-year follow-up are presented in Table 6. The number of teeth was high in both instrumentalist categories and the number of teeth lost over the 10 years was limited. There were no statistically significant differences between wind and non-wind instrumentalists. Oral hygiene, as expressed by the plaque index, was as a mean (SD) 0.82 (0.38) at baseline and 0.74 (0.29) at follow-up. The difference was not statistically significant.

Mean (SD) periodontal bone heights at baseline were 83.1% (5.72) and 82.6% (6.65) in wind- and non-wind instrumentalists, respectively. The mean (SD) reduction over the 10-year period was 0.94% (3.51) in wind instrumentalists and 0.74% (3.34) in non-wind instrumentalists. The reductions within instrumentalist categories over time were not statistically significant, with the exception of wind instrumentalists of the 50–69-year age group ($t = 4.24$, $p < 0.05$). The difference between the wind and the non-wind instrument musicians was not statistically significant. This held true also within the two age-specific subgroups.

Discussion

When evaluating the results of the present study, the number and measurability of teeth remaining should be

considered. The number of teeth was high in all age groups; even in the age group 60–69 years the average number of teeth remaining was 25. In the present sample of subjects the number of remaining teeth was higher than in adult regular dental care attendants, as reported by Wennström et al. (6) and also compared to the sample of musicians examined 10 years earlier by Bergström & Eliasson (12).

The inclusion criteria for measurability were rigorous and all landmarks defined had to be identified, otherwise the tooth was excluded. Seventeen percent of the teeth were excluded using these rigorous criteria. The percentage of teeth excluded is lower in 1992 than in a corresponding study in 1982 (9). The low exclusion rate and the high number of teeth remaining indicate that the influence of error of measurement is considered to be limited, which is important when comparing group means over time.

The values for plaque index and gingival index were low and with fairly small variations for different age groups. There was a tendency for increasing values for gingival index with age from 0.71 in the 20–29-year age group to 0.90 in 60–69-year group. Plaque index, however, exhibited the highest value, i.e. 0.88 for the 20–29-year age group, but ranged 0.7–0.8 in other age groups. Compared to the earlier examination (in 1982) by Bergström & Eliasson (12), however, the values for both indices have decreased. This might reflect a population that has a positive dental health attitude and enjoys regular dental care. This part of the Swedish population is substantial and steadily increasing (2).

The periodontal bone height was high in all age groups and the differences between wind and non-wind instru-

mentalists were small and statistically non-significant. Although the bone height varied for different tooth groups, with high bone height values for canines and low values for maxillary molars and mandibular incisors, the bone height level showed a recurrent pattern for different age groups. Bone height decreased with age from 86% in the 20–29-year age group to 77% in the 60–69 years group. The reduction in bone height by age is smaller than in the corresponding study in 1982 (9). This is due to higher bone height values in the 50–59 and 60–69-year age groups. Furthermore, the bone height values are considerably higher than those arrived at by Wennström et al., (13) in a periodontitis patient population. The high number of remaining teeth, the low values for plaque index and gingival index, and the high values for periodontal bone height indicate that the present population is characterized by a periodontal health status above the normal.

In the present cross-sectional study, the differences for quotients among different tooth groups were small. There were no statistically significant differences in quotients between wind- and non-wind instrumentalists, indicating that playing wind instrument does not seem to have any influence on periodontal bone height, which is in agreement with earlier results (9).

The longitudinal study indicates a small but statistically significant reduction of periodontal bone height with age. The magnitude of the difference between consecutive age groups tended to increase with age. This trend is in agreement with earlier studies (4, 14–18). Statistically significant differences between wind and non-wind instrumentalists could not be established for the total population nor for age subgroups. Over time, however, the reduction in bone height for wind instrumentalists of the 50–69-year age group was statistically significant. The playing of a wind instrument may therefore imply an increased risk for bone height reduction.

In conclusion, the present cross-sectional study indicates periodontal health above average in musicians playing wind and non-wind instruments as characterized by number of remaining teeth, plaque index, gingival index, and periodontal bone height. The longitudinal study indicates that over a 10-year period the rate of periodontal bone height reduction is low, but there were no statistically significant differences between wind and non-wind instrumentalists present.

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