Alveolar bone height in professional musicians

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This study aimed at determining alveolar bone height in musicians playing wind instruments and non-wind instruments. Two hundred and forty-two subjects, 208 men and 34 women, from 3 national orchestras in Stockholm were examined in an intraoral full-mouth survey. The height of alveolar bone, registered by a computerized method, was expressed as a percentage of the root length. Mean alveolar bone height varied from 87.4% in subjects aged 21–30 years to 73.6% in subjects aged 51–60 years. There were no significant differences between the two categories of instrumentalists in any age group. With regard to individual teeth, the greatest values of bone height were observed for canines and second premolars, whereas mandibular incisors and maxillary molars displayed the lowest values. The alveolar bone height was not significantly different for the two categories of instrumentalists in either anterior teeth or posterior teeth. It is concluded that playing wind instruments does not influence the alveolar bone height to such an extent as to be detectable on a large-scale epidemiologic basis. □ *Periodontology; radiography*

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Alveolar marginal bone height decreases with increasing age and with deterioration of oral hygiene (1–5). Loss of alveolar bone height resulting from periodontal disease may imply hypermobility and, finally, loss of teeth. For individuals who are professionally dependent on stable teeth, hypermobility or loss of teeth may be devastating. Musicians who play wind instruments are a group of professionals for whom stable teeth are of vital importance for their performing ability. Different views have been presented in the literature with regard to periodontal conditions in musicians who play wind instruments. Some previous studies seem to have found that periodontal disease occurs frequently in wind instrument players (for a review, see Kilpinen (6)). However, these studies are often incomplete with regard to, for example, diagnostic criteria and use of control group. Only a few studies include controls (6, 7). According to these studies there was no difference between the periodontal health in wind instrumentalists and controls. However, none of the previous studies include detailed radiographic evaluation of the alveolar bone height.

In an earlier study (8) we recorded dental care habits, oral hygiene, and gingival health in a sample of Swedish professional musicians and found them to have a high standard. The purpose of the present investigation was to determine alveolar bone height in this sample and to compare alveolar bone height in musicians playing wind instruments with that in musicians playing non-wind instruments.

Materials and methods

Subjects

The subject material comprised 242 musicians (208 men and 34 women), members of 3 national orchestras in Stockholm (Table 1). Of the total sample 100 subjects were wind instrument players. Brass instrument players included musicians playing the trumpet, horn, tuba, or trombone, and woodwind instrument players included musicians playing the clarinet, saxophone, oboe, bassoon, or flute. A further account of the material has been presented elsewhere (8). The original sample was reduced by

Table 1. Distribution of the material by age and instrument played

Age group, years	Brass instrument players, *n*	Wood instrument players, *n*	Non-wind instrument players, *n*	Total, *n*
21–30	12	11	24	47
31–40	9	12	38	59
41–50	14	14	43	71
51–60	15	13	37	65
Total	50	50	142	242

eight subjects who did not want to take part in the radiographic examination. The mean number of teeth remaining varied from 27.1 in the age group 21–30 years to 24.0 in the age group 51–60 years (9). Gingival index and plaque index for the sample are shown in Table 2.

Radiographic examination

All subjects were examined by an intraoral full-mouth survey including 16 periapical radiographs—4 posterior and 5 anterior in the upper jaw and 4 posterior and 3 anterior in the lower jaw. The examination was performed with a modified paralleling and long-distance technique. The film was positioned by means of a filmholder of cellular plastic and as parallel as possible to the longitudinal axis of the tooth. The X-ray machines used, operating at 65–72 kVp, were equipped with a rectangular tube (Rinn) giving at least 0.20 m target-to-skin distance. The film used was Kodak Ekta Speed (speed group E). All examinations were performed at the Department of Oral Radiology, School of Dentistry, in Stockholm by specially trained assistants under the supervision of one of the authors.

Evaluation technology

The alveolar bone height was determined from the radiographs by means of a graphic data system. The system comprised a computer, a digitized graphic tablet (Tektronix 4953) with a cursor (no. 119-0622-00), and a graphic screen terminal (10). The size of the active writing area of the tablet was 260 × 260 mm. According to the manufacturer, the resolution was 0.25 mm. The radiographs were magnified fivefold in a slide projector and projected onto the graphic tablet. The longitudinal axis of the tooth was oriented along one axis in the coordinate system on the graphic tablet.

Measurement procedure

The proximal alveolar bone height was evaluated mesially and distally to each tooth 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 the 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

Table 2. Plaque index and gingival index. Means ($\bar{x}$) and standard errors of the means (SEM) by age and instrument played

Age group, years	Plaque index				Gingival index			
	Wind		Non-wind		Wind		Non-wind	
	$\bar{x}$	SEM	$\bar{x}$	SEM	$\bar{x}$	SEM	$\bar{x}$	SEM
21–30	0.75	0.08	0.69	0.07	1.12	0.06	1.03	0.08
31–40	0.73	0.07	0.81	0.06	1.17	0.07	1.17	0.06
41–50	0.88	0.07	1.06	0.12	1.22	0.06	1.43	0.12
51–60	1.02	0.07	0.87	0.07	1.40	0.05	1.26	0.08
Total	0.85	0.04	0.89	0.04	1.23	0.03	1.25	0.05

height of the alveolar 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, owing, for example, to restoration or overlapping, the tooth was excluded. Altogether 22% of the teeth were excluded. As can be seen in Fig. 1, the number of teeth excluded increased with age. Maxillary teeth were excluded more frequently than mandibular ones. The teeth most often excluded were maxillary canines, second molars, and first premolars. A mean alveolar 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.

At the time of registration, no information was available as to the instruments played.

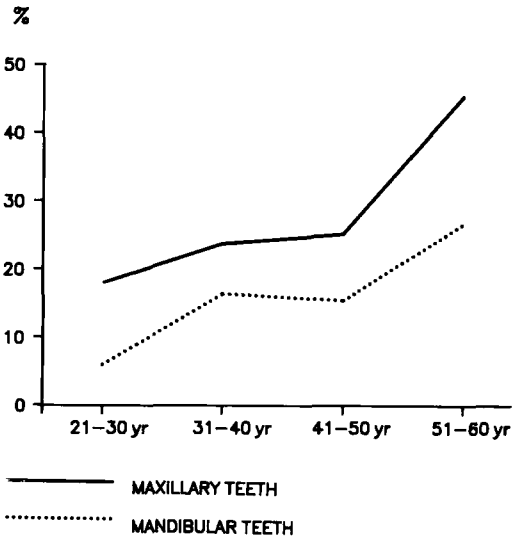


Fig. 1. Percentage of teeth excluded in the maxilla and the mandible, by age.

Statistics

The statistical significance of differences between means was tested with Student's *t* test. Significance was accepted at the level $P < 0.05$.

Reproducibility

The precision of the bone height measurement procedure was estimated by duplicate measurements in 20 randomly selected subjects. A mean based on all measurements was established for each subject. The measurements were repeated after an interval

Table 3. Alveolar bone height in percentage of root length. Means ($\bar{x}$) and standard deviations (SD) by age and instrument played

Age group, years	Wind instrument players		Non-wind instrument players		Total	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
21–30	87.3	3.0	87.6	3.6	87.4 ***	3.7
31–40	84.1	5.1	84.8	4.1	84.5 **	4.5
41–50	81.4	7.5	81.5	6.5	81.5 ***	6.9
51–60	76.0	7.8	71.8	11.4	73.6	10.6
Total	82.0	7.5	80.4	9.6	81.0	8.8

**$P < 0.01$.
***$P < 0.001$.

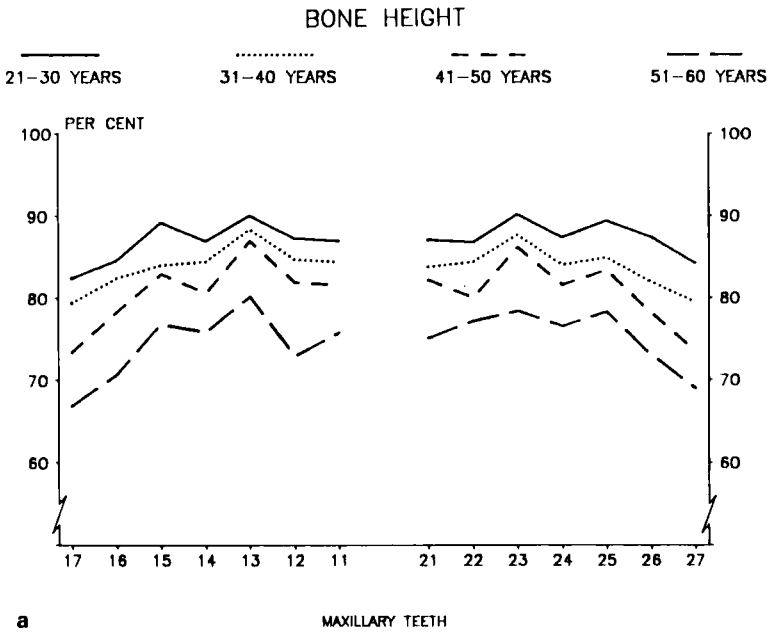
of at least 1 day. The precision(s) of the measurement procedure was calculated by means of the formula

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

where d_i is the difference between the two mean values, and n is the number of differences. The precision thus found was $s = \pm 0.6\%$.

Sex differences

A comparison was made between the



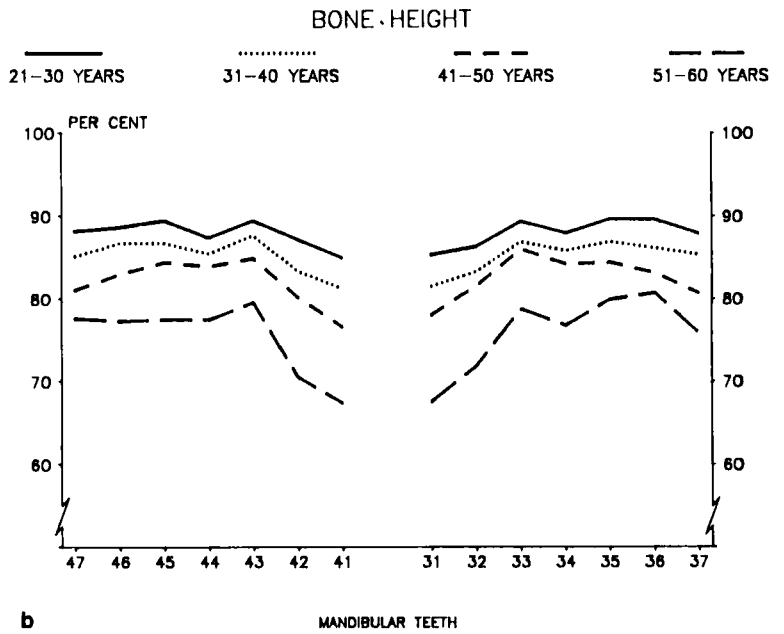


Fig. 2a and b. Percentage alveolar bone height by age and tooth number in the maxilla and the mandible.

women and an age-matched male sub-sample. No statistically significant differences were found in mean alveolar bone height between men and women. The women were therefore included in the analyses of data.

Results

The mean alveolar bone height in the four age groups decreased from 87.4% in subjects aged 21–30 years to 73.6% in subjects aged 51–60 years (Table 3). The differences between all age groups were statistically significant ($P < 0.01$). The differences within age groups between wind and non-wind instrument musicians were small and not statistically significant ($P > 0.05$).

The variation of alveolar bone height by tooth number and age is shown in Figs. 2a and 2b. Almost invariably, canines and second premolars in both jaws had the greatest values; the lowest values were found in maxillary molars and mandibular incisors. A gradual reduction in bone height with age was observed for all teeth. The interrelationship between the various teeth remained almost constant throughout all age groups.

The quotients in bone height formed between incisors, premolars, and molars are presented in Table 4. For maxillary teeth the quotient of incisors to molars and the quotient of premolars to molars were well above unity. For mandibular teeth the quotient of incisors to premolars and the quotient of incisors to molars were below unity. The values of the quotients indicate small variations in alveolar bone height for various groups of teeth and confirm the results shown in Fig. 2. The quotients shown in Table 4 were not statistically different with regard to instrumentalist category ($P > 0.05$). A further analysis of the quotients by age and instrumentalist category did not yield any statistically significant differences in any age group between wind and non-wind instrument musicians ($P > 0.05$). Nor were there any significant differences between brass and woodwind instrumentalists.

Discussion

In this study men are in the majority, which reflects the situation among the musicians in the three orchestras. This fact does not seem to have any bearing on the results, since there was no difference between men and women with regard to the average bone height. This is in agreement with earlier observations (3–5, 11).

Alveolar bone height was determined in relation to the root length; the greatest mean value, 87.4%, was found in the 21- to 30-year age group. However, the maximum height of the alveolar bone is not 100%, even under periodontally healthy conditions. This fact should be considered when the results are

Table 4. Quotients of alveolar bone height between various groups of teeth. Means ($\bar{x}$) and standard errors of the means (SEM) for brass instrument players, woodwind instrument players, and non-wind instrument players

	Brass			Woodwind			Non-wind		
	n	$\bar{x}$	SEM	*n*	$\bar{x}$	SEM	*n*	$\bar{x}$	SEM
Maxillary teeth									
Incisors/molars	48	1.07	0.013	44	1.10	0.022	118	1.06	0.011
Incisors/premolars	48	0.99	0.007	44	1.00	0.008	120	0.99	0.005
Premolars/molars	48	1.08	0.012	43	1.09	0.023	119	1.07	0.011
Mandibular teeth									
Incisors/molars	48	0.99	0.013	48	0.94	0.009	127	0.95	0.008
Incisors/premolars	50	0.95	0.007	50	0.93	0.011	130	0.93	0.008
Premolars/molars	47	1.04	0.014	48	1.01	0.007	130	1.02	0.006

evaluated. The height of the alveolar bone as determined in young healthy adults with the projection technique described was 90–95% (12).

Alveolar bone height differed within the dentition. Part of this variation is attributable to the method of determination. When bone height is given in relation to the root length, teeth with long roots will be favored as compared with those with short ones. To what extent the bone height values observed are influenced by the method of determination is not fully known and remains to be evaluated. However, they are valid for comparison of different groups of subjects in this sample. Furthermore, the present method of evaluation will probably give more precise measures of the alveolar bone height than methods using an interval scale. An optimal radiographic projection technique, however, is a basic prerequisite.

Other factors to be taken into consideration when evaluating the results are the number and the measurability of teeth remaining. The number of teeth remaining was high in all age groups (9). The criteria of measurability were rigorous. All landmarks defined had to be unanimously identified, mesially as well as distally, otherwise the tooth was excluded. By these rigorous criteria, 22% of the teeth were excluded. The teeth most often excluded were the maxillary canines. Canines were therefore disregarded when forming the quotients between groups of teeth. Altogether, missing teeth and exclusion of teeth due to non-measurability are thought not to have seriously affected the results.

Within all age groups the alveolar bone height showed a recurrent pattern, which included relatively high values for canines and relatively low values for maxillary molars and mandibular incisors. Although bone height decreased with age in the present sample, it was high even in subjects aged 51–60 years. The difference compared with subjects aged 21–30 years was 13.8%, suggesting a rather moderate reduction of bone height with age. It is conceivable that the high standard of oral hygiene in the present sample is one reason for such a limited reduction.

Other factors besides age and oral hygiene may influence the alveolar bone height. Excessive forces exerted on teeth and periodontia, such as trauma from occlusion, may be associated with increased loss of alveolar bone in the presence of inflammation (16, 17). It has been argued that the playing of wind instruments may exert excessive force on the teeth and periodontia (7, 18, 19). If so, its effect might be similar to that of trauma from occlusion. However, the present findings do not suggest an increased reduction of bone height in wind instrumentalists, either for the dentition as a whole or for the anterior regions. Thus, it would seem that in the presence of a good standard of oral hygiene, the playing of wind instruments does not imply an increased risk of alveolar bone loss.

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