From: The Norwegian Institute of Dental Research. Head: Dr. philos. B. Nygaard Östby.

ALVEOLAR BONE LOSS AS A FUNCTION OF TOBACCO CONSUMPTION

by

ARNULF ARNO*
OLAV SCHEI*
ARNE LOVDAL*
JENS WÆEHAUG**

Alveolar bone loss as related to tobacco consumption has been studied roentgenologically by *Herulf*[2] in a group of about 600 dental students. Herulf confined the measurements to the lower front teeth as these allow the most accurate measurements to be made. He concluded that the bone loss was significantly greater among the smokers than among those who did not smoke.

Pindborg[6] observed a significant increase in the incidence of ulcerative gingivitis with increasing tobacco consumption in a group of Danish marines. A similar increase in the incidence of simple gingivitis was observed by *Arno et al.*[1]

In a roentgenologic evaluation of the alveolar bone resorption as a function of oral hygiene, *Schei et al.*[7] found a marked increase in bone loss with decreasing efficiency of tooth brushing. The difference was manifest, although slight, in the age group 21—25 years and increased steadily with age. The same material was used by *Lovdal et al.*[3] in a study of the effect of occlusal stress on the alveolar bone resorption. They observed a significant increase in the mobility of the "heavily loaded" teeth as compared with those in normal function, but there was no significant difference in the height of the alveolar bone.

The object of the present investigation is to evaluate the influence of tobacco consumption on the speed of alveolar bone resorption.

* Research fellow, Norwegian Institute of Dental Research.

** Professor of Dentistry and Head of the Department of Periodontics and Crown and Bridgework, Norwegian State Dental School, Oslo, Norway.

MATERIAL AND METHOD

The examination was carried out on 728 male workers and staff members of a modern industrial plant in Oslo, Norway. The material was divided into five age groups: 21—25, 26—30, 31—35, 36—40 and 41—45 years.

The tobacco consumption was assessed on the basis of interrogation. Most of the tobacco was consumed as cigarettes, and other kinds of tobacco were calculated in equivalence of cigarettes according to the formula of *Pindborg*.[4] The individuals were classified in four groups, (1) no consumption, (2) small (1—9 cigarettes a day), (3) medium (10—20 cigarettes), and (4) large consumption (more than 20 cigarettes).

The men were also classified in one of the three hygiene groups according to the efficiency of their oral hygiene: (1) good, (2) medium and (3) not good. It was necessary to bring the effect of oral hygiene into the analysis because it had been demonstrated previously that this variable had a marked effect on the bone loss.[4]

A set of 10 dental roentgenographs were taken of each individual, and by means of a specially prepared translucent ruler the alveolar bone loss was measured in percentage of maximum bone height. When the alveolar crest was located 1 mm from or closer to the cemento-enamel junction, it was considered to be of optimal height. If possible, two measurements (mesial and distal) were made for all the teeth except the wisdom teeth. This should give a maximum of 56 observations for each patient. However, because of loss of teeth and technical difficulties associated with the measurements (overlapping etc.), the average number became considerably smaller, i.e. 34 for each person. As a systematic difference in the loss of bone around the various teeth has been demonstrated, all the observations from all the 56 surfaces were calculated separately in the analysis. For further details see *Schei et al.*[7]

STATISTICAL ANALYSIS

The distribution of the material according to age, oral hygiene and tobacco consumption is shown in Table I. In Table II the material is classified according to age and oral hygiene with no

Table I

Distribution of the material according to age, oral hygiene and tobacco consumption.

Age	Oral hygiene	Tobacco consumption				Total
		None	Small	Medium	Large	
21—25 years	Good	4	3	4	2	13
	Medium	14	3	35	8	60
	Not good	3	0	6	0	9
26—30 years	Good	13	3	7	2	25
	Medium	16	13	56	16	101
	Not good	1	2	8	11	22
31—35 years	Good	7	4	10	4	25
	Medium	30	18	60	29	137
	Not good	4	9	21	16	50
36—40 years	Good	5	2	3	4	14
	Medium	18	10	31	30	89
	Not good	8	4	38	14	64
41—45 years	Good	4	2	2	2	10
	Medium	8	8	29	11	56
	Not good	13	8	23	9	53
Total		148	89	333	158	728

regard to tobacco consumption. From Table II it appears that the oral hygiene becomes poorer with increasing age. In Table III the material is arranged according to age and tobacco consumption. The tobacco consumption tends to increase with increasing age, although there are some irregularities.

As it was known that the bone loss was influenced by age and

Table II

Distribution of the material (%) according to age and oral hygiene.

Age	Oral hygiene			Total
	Good	Medium	Not good	
21—25 years	15.8	73.2	11.0	100
26—30 years	16.9	68.2	14.9	100
31—35 years	11.8	64.6	23.6	100
36—40 years	8.4	53.3	38.3	100
41—45 years	8.4	47.1	44.5	100

Table III

Distribution of the material (%) according to age and tobacco consumption.

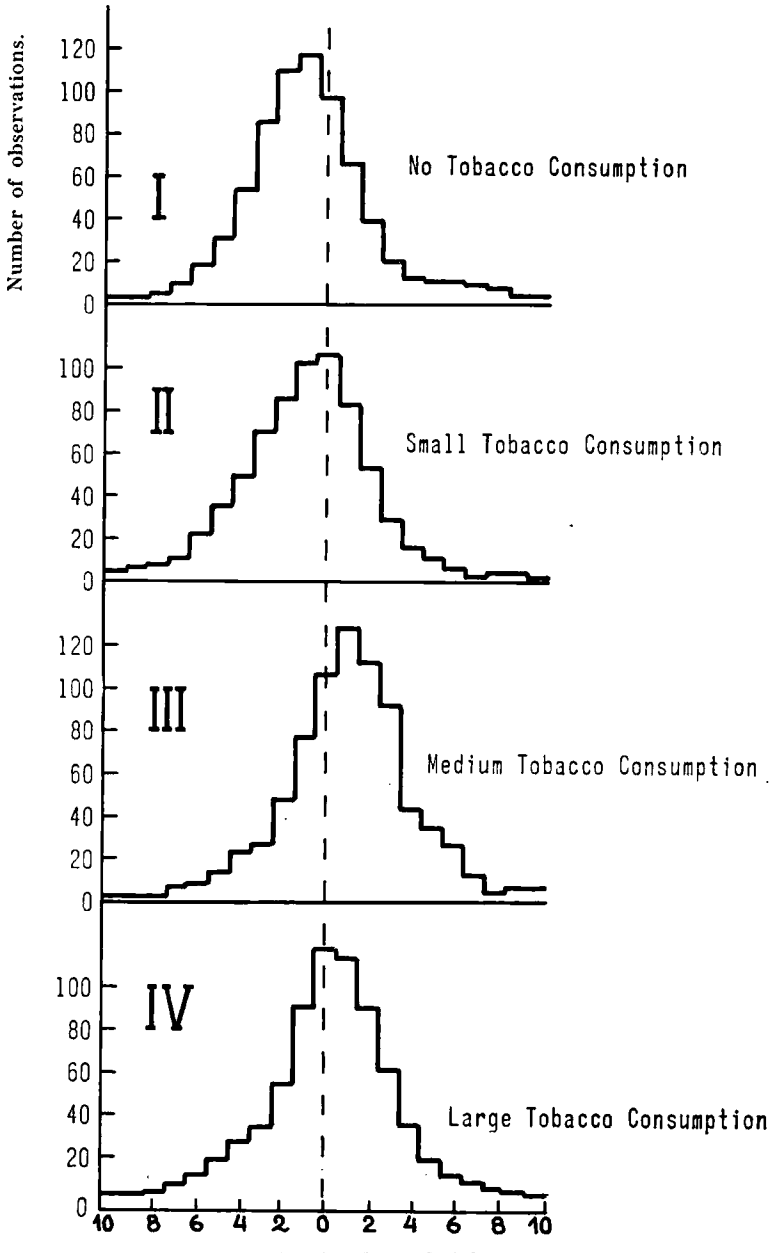
Age	Tobacco consumption				Total
	None	Small	Medium	Large	
21—25 years	25.6	7.3	54.9	12.2	100
26—30 years	20.3	12.1	48.0	19.6	100
31—35 years	19.4	14.6	42.9	23.1	100
36—40 years	18.6	9.6	43.1	28.7	100
41—45 years	21.0	15.1	45.4	18.5	100

oral hygiene, and that it was different for the front teeth, the molars etc. the material had to be grouped according to all these insignia simultaneously. Five age groups, 3 hygiene groups and 56 surfaces ($5\times3\times56$) gave 840 specified "cells". Within each cell the effect of age, hygiene and localization was constant, and the pure effect of tobacco could be evaluated.

Within each of the 840 cells the average percentage of bone height was calculated for the four groups of tobacco consumption. These four averages were compared with the *total* average within each cell and the deviations tabulated. The deviations (in 840 cells) were arranged as frequency distributions, one distribution for each group of tobacco consumption (Diagrams I—IV in Fig, 1). These distributions seem to show a small, although distinct difference between the four groups of tobacco consumption. In the group with no tobacco consumption the distribution is concentrated to the left of the 0-line. In the group with small tobacco consumption the main weight is seen close to the 0-line, but is still to the left. In the group with medium and large tobacco consumption, however, the main weight is clearly to the right of the 0-line.

To decide whether or not the difference between the four groups was significant an analysis of variance was carried out. On account of the detailed grouping according to age, hygiene and localization, there were many cells without observations in the oral hygiene groups "good" and "not good". Therefore, the variance analysis had to be confined to the group with "medium" oral hygiene, (about 60 % of the material). As far as the varia-

Fig. 1. Frequency distributions of the deviations from the cell averages.



tion quotient is concerned, the analysis showed with a great margin of certainty that the difference could not be due to chance.

DISCUSSION

On the basis of this material there seems to be a systematic correlation between bone loss and tobacco consumption, although the effect of tobacco is not of the same importance as that of oral hygiene (*Schei et al.*).[7] These findings are in agreement with *Herulf's*[2] conclusion that alveolar bone loss is influenced by tobacco consumption. However, there is no clue as to the way in which the tobacco acts. Furthermore, this analysis demonstrates that the effect of tobacco in this material is not limited to the soft tissues alone, but is extended to the alveolar bone as well.

This study and earlier studies suggest that tobacco consumption is a complicating factor in periodontal disease, which in connection with poor oral hygiene and unfavourable systemic background may help speeding up the destruction of the supporting tissues of the teeth.

SUMMARY AND CONCLUSIONS

The effect of tobacco consumption on the alveolar bone loss was evaluated roentgenographically in a group of 728 men between 21 and 45 years of age. The bone loss was measured in percentage of maximum bone height adjacent to the mesial and distal surfaces of each tooth present. The effect of age and oral hygiene was also brought into the analysis.

On the basis of the statistical evaluation the following conclusions seem to be justified: (1) alveolar bone loss increases with increasing tobacco consumption, (2) tobacco consumption may be a complicating factor in the etiology of periodontal disease, but is hardly a dominating factor.

RESUME

LA RESORPTION DE L'OS ALVEOLAIRE EN FONCTION DE L'USAGE DU TABAC

L'effet sur la résorption alvéolaire de l'usage du tabac a fait l'objet d'une étude radiographique sur un groupe se composant de 728 hommes âgés de 21 à 45 ans.

Les mesures de la résorption osseuse ont été exprimées en p. 100 par rapport à la hauteur osseuse maximum sur la face mésiale et sur la face distale de chaque dent. L'effet de l'âge et de l'hygiène buccale a aussi été compris dans l'analyse statistique.

Les résultats de cette étude semblent justifier les conclusions suivantes:

(1) La résorption alvéolaire s'accroît avec l'augmentation de l'usage du tabac.

(2) L'usage du tabac semble être une des causes des affections parodontaires, mais n'est vraisemblablement pas un facteur dominant.

ZUSAMMENFASSUNG

DIE WIRKUNG DES TABAKVERBRAUCHES AUF DEM ALVEOLAREN KNOCHENSCHWUND

Die Wirkung des Tabakverbrauches auf den alveolaren Knochenschwund wurde röntgenologisch bei einer Gruppe von 728 Männern im Alter von 21 bis 45 Jahren untersucht.

Der Knochenschwund wurde prozentual durch die maximale Knochenhöhe an der Mesial- und Distalfläche eines jeden Zahnes errechnet. Der Einfluss von Alter und Mundhygiene wurde gleichzeitig mit in der statistischen Analyse untersucht.

Auf Grund dieser Untersuchung meint man folgende Konklusion ziehen zu dürfen:

1) Der alveolare Knochenschwund wird grösser mit steigendem Tabakgenuss.

2) Der Tabakgenuss scheint Anteil zu haben an den parodontalen Erkrankungen, ist kausal aber kaum dominierend.

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Address: *Odontologisk forskningsinstitutt*
Josefinegate 32
Oslo, Norway