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## PERIODONTAL CONDITIONS IN A FINNISH RURAL POPULATION

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### INTRODUCTION

In Scandinavia only a few epidemiological studies on the prevalence and severity of periodontal disease have been carried out so far. Oslo industrial workers and staff members showed an incidence of 90—100 % gingival inflammation in males over 20 years of age (*Lövdal & al.* 1958). In Iceland 9 out of 10 inhabitants over 4 years of age had some form of periodontal disease (*Dunbar et al.* 1968). In a Finnish mixed urban and rural population the corresponding prevalences were close to 100 % in both males and females (*Helminen-Pakkala* 1968). Markedly lower values were recorded in a purely rural Finnish population by *Sirilä & Lindberg* (1965).

In a previous report by the present authors (*Alvesalo & Ainamo* 1968) the participation rates of the Hailuoto inhabitants in a dental and genetic study were reported to have been 50 % in both males and females. A total of 46 % of the subjects over 20 years of age were found edentulous. In the present report the periodontal conditions of this rural population will be analysed.

### MATERIAL AND METHODS

Hailuoto is an island about 200 square kilometers in size located 10 km off the western coast of Finland at the 65th parallel. Its approximately 1300 inhabitants live mainly on agriculture, on collecting and exporting lichen and

on fishing. Dental care for school children on the island has been irregularly available during one or two summer months each year for the last fifteen years. Adults have had to seek dental treatment from the mainland. Because of poor means of communication this therapy has mainly consisted of extractions and subsequent insertion of removable dentures.

All islanders were informed about and invited to the examination; 648 participated. As the periodontal examination was restricted to only permanent dentitions, the sample of the present report consists of 528 over twelve year old persons. The material was grouped into males and females and into age groups representing successive decades of life (Table 1). Teenagers were, however, further divided into two age groups, those in puberty (12—15 years) and those in their late teens (16—19 years). The two age groups of 60—69 and 70—79 years, on the other hand, were combined to form one group of 60—79- year-old males and females.

The clinical examination was carried out in a dental chair in good artificial light. All scorings were made by one investigator (L.A.) after thorough calibration with two instructors at the Department of Periodontology of the Institute of Dentistry in Turku. Russell's periodontal index (*PI*) was used for registration of gingival inflammation and loss of supporting tissue (*Russell* 1956). This index, however, was modified so that number 6 was scored as well for pocket formation as for gingival retraction. The oral hygiene index (*OHI-S*) including debris (*DI-S*) and calculus indexes (*CI-S*) were scored as suggested by *Greene* (1964). Scorings were made only from dentitions comprising a minimum of four remaining teeth with suitable location in either jaw. Such dentitions will in this report be referred to as measurable dentitions.

#### RESULTS

*Measurable dentitions.* Table I shows the numbers of females and males examined in the various age groups. Out of a total of 253 males 143 presented measurable dentitions as compared with only 115 out of 275 females. The corresponding total frequencies of measurability when determined in per cent were 57 % and 42 %, respectively (Fig. 1). A few mixed dentitions still occurred in the age groups 12—15 years. Extensive loss of teeth which started at around age 20, resulted in 50 % nonmeasurable dentitions in females 30—39 years and in males 40—49 years of age. In the age group 60—79 years only 3 females out of 49 (6 %) were left with enough remaining teeth to allow periodontal and oral hygiene scorings. No measurable dentitions were presented by the few examined males and females aged 80 years or more (Table I, Fig. 1).

Table I

Total material and numbers of measurable dentitions in females and males of the various age groups

Age	Total material			Measurable dentitions		
	F	M	Total	F	M	Total
12-15	36	32	68	31	28	59
16-19	31	30	61	30	29	59
20-29	38	30	68	27	21	48
30-39	23	28	51	11	22	33
40-49	47	31	78	9	11	20
50-59	46	46	92	4	19	23
60-79	49	55	104	3	13	16
80-	5	1	6	—	—	—
Total	275	253	528	115	143	258

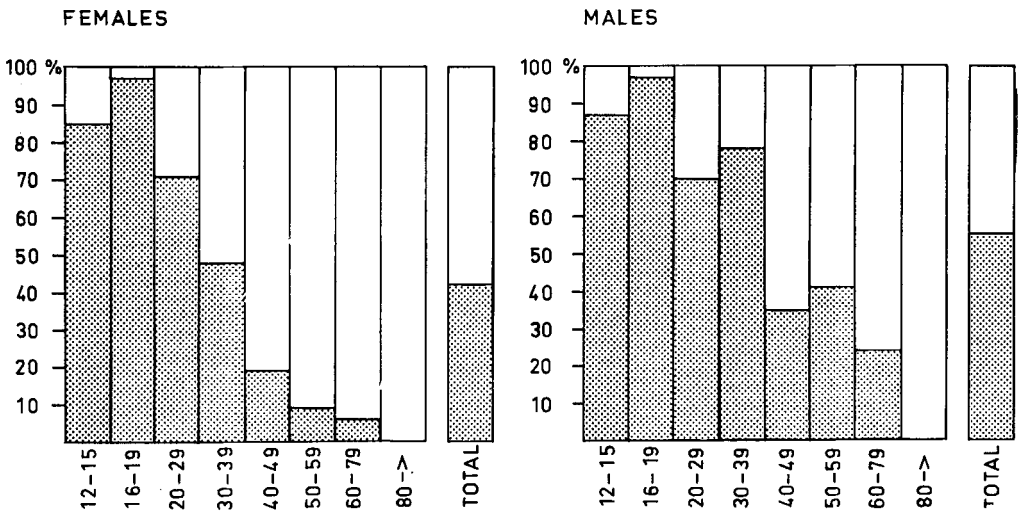


Fig. 1. Frequencies of measurable dentitions in males and females of various age groups.

*Debris.* Table II shows the mean debris index (*DI-S*), calculus index (*CI-S*), oral hygiene index (*OHI-S*) and periodontal index (*PI*) scores in males and females of the various age groups. The debris index showed in both sexes only a slight tendency towards higher mean values with advancing age. In all age groups the mean debris indexes were somewhat higher in males than in females as is shown also graphically in Fig. 2. The lowest *DI-S* scores (0.93) were recorded for females 16–39 years of age and the highest (*DI-S* = 1.65) for males in the oldest age group. In both sexes a slight decrease in the amount of oral debris was observed after puberty. Another period of improved cleanliness was noticed in males 40–49 years of age (Table II, Fig. 2).

Table II

*Mean debris index (DI-S), calculus index (CI-S), oral hygiene index (OHI-S) and periodontal index (PI) scores of males (M) and females (F) of the various age groups*

Age	No		DI-S		CI-S		OHI-S		PI	
	F	M	F	M	F	M	F	M	F	M
12–15	31	28	0.98	1.33	0.05	0.02	1.03	1.34	0.70	0.34
16–19	30	29	0.93	1.18	0.13	0.23	1.05	1.41	0.52	0.68
20–29	27	21	0.94	1.18	0.24	0.40	1.17	1.58	0.90	0.95
30–39	11	22	0.93	1.34	0.50	1.17	1.43	2.50	1.01	2.71
40–49	9	11	1.14	1.18	1.17	1.39	2.31	2.58	3.02	4.82
50–59	4	19	1.22	1.42	1.77	1.65	2.99	3.07	3.80	5.22
60–79	3	13	1.17	1.65	2.00	1.60	3.17	3.25	6.00	5.67
Total	115	143	0.97	1.30	0.30	0.74	1.27	2.04	1.08	2.34

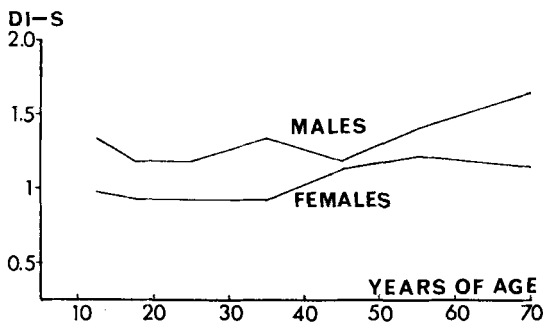


Fig. 2. Mean debris index levels through age in males and females.

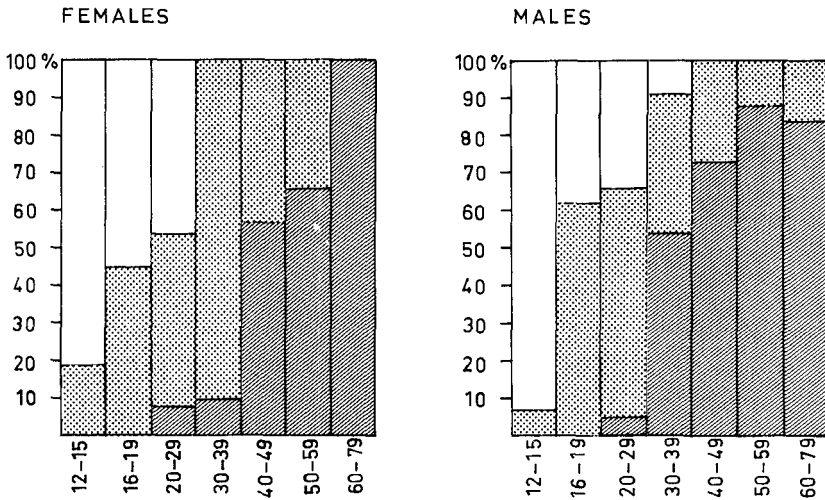


Fig. 3. Occurrence of supragingival ( $CI-S = 0.17-1.0$ ) and subgingival ( $CI-S = 1.01$  and over) calculus in males and females of various age groups.

*Calculus.* From 12 to 59 years of age the mean calculus indexes showed continuously increasing values in both males and females (Table II). Men seemed to have more calculus in the age groups 16-49 years whereas in the youngest and in the two oldest age groups women presented higher  $CI-S$  values. The difference between the two sexes was greatest in the age group 30-39 years, in which females scored a mean calculus index of 0.50 as compared with the index value 1.17 of the males (Table II).

For determination of the prevalence of mineralized deposits, the individual dental calculus indexes were roughly grouped into those indicating supragingival ( $CI-S=0.17-1.0$ ) and subgingival ( $CI-S=1.01$  and over) calculus. Fig. 3. shows that only in the youngest age group calculus was found more often in females (18 %) than in males (7 %). Subgingival calculus started to occur from age 20 in both sexes. All males after 40 and all females after 30 years of age presented either one of these types of calculus, but the subgingival type occurred more frequently in males than in females starting from the age group 30-39 years.

*Oral hygiene index.* By adding the individual debris index scores to those of the calculus index the mean oral hygiene indexes of males and females were calculated for the various age groups (Table II). In all age groups men presented higher oral hygiene index scorings than women. Both sexes showed

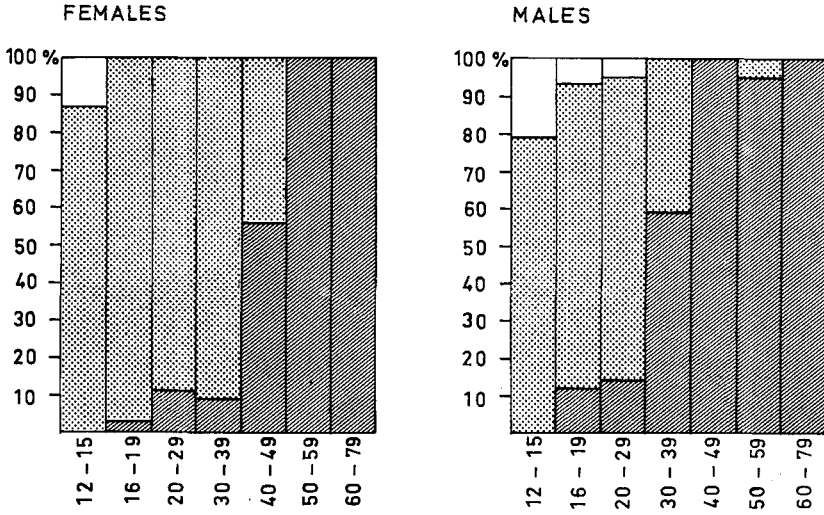


Fig. 4. Occurrence of gingivitis (PI = 0.01-2.0) and periodontal breakdown (PI = 2.01 and over) in males and females of various age groups.

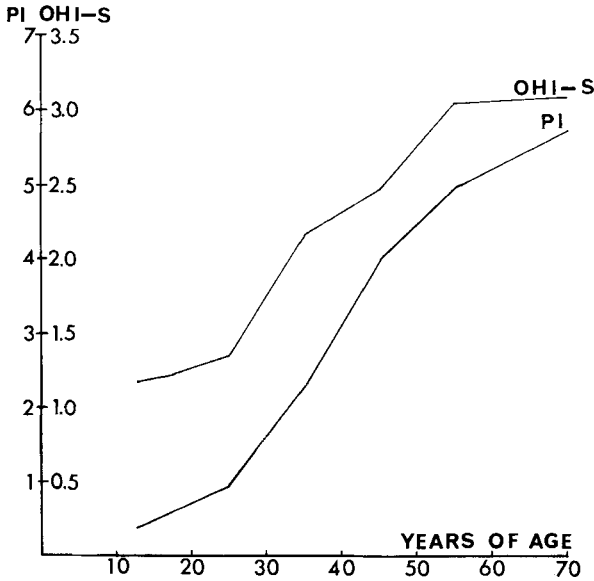


Fig. 5. Mean index levels of oral hygiene and periodontal disease through age in total population

continuous growth with age of their index values. The lowest mean *OHI-S* (1.03) was scored in 12—15-year-old girls and the highest (3.25) in the group of 60-79-year-old men. The difference between the two sexes was again greatest in the age group 30—39 years, in which men scored an average *OHI-S* of 2.50 and women only 1.43. The influence of age on the oral hygiene of the total material is presented graphically in Fig. 5.

*Periodontal disease.* In all but the youngest age group males scored higher *PI* values than females which resulted in mean *PI* scores of 1.08 for all females and 2.34 for all males (Table II). The periodontal indexes showed continuous growth with advancing age in both sexes, with only one exception in form of a temporary decrease of mean severity from  $PI = 0.70$  in 12—15-year-old girls to  $PI = 0.51$  in girls aged 16—19 years (Table II). Periods of abrupt impairment of periodontal conditions were observed in males starting from age 30 and in females starting from 40 years of age. The influence of age on the pooled periodontal indexes of males and females is shown graphically together with the oral hygiene index curve in Fig. 5. According to this presentation, the mean *PI* score equaled 1.6 and the mean *OHI-S* score 1.75 at the age of 30 years. The corresponding mean values of the total material at 50 years of age were  $PI = 4.35$  and  $OHI-S = 2.7$ .

The prevalence of periodontal disease was assessed in males and females of the various age groups by determining the numbers of persons presenting gingivitis ( $PI = 0.01-2.0$ ) or periodontal breakdown ( $PI = 2.01$  and over) in per cent of the total material of measurable dentitions (Fig. 4). Nearly 90 % of the girls and about 80 % of the boys in the youngest age group showed signs of gingivitis. This prevalence reached 100 % in females past 16 and in males past 30 years of age. Loss of supporting tissue was scored in both sexes starting from the age period 16—19 years. In males, however, periodontal breakdown showed a drastic increase in frequency in the age group 30—39 years whereas the corresponding age period of increased prevalence occurred ten years later, in the age 40—49 years, in females. Males after 40 and females after 50 years of age all presented signs of periodontal breakdown.

#### DISCUSSION

As to the prevalence of periodontal disease (Fig. 4) the present results agreed with earlier Scandinavian data (Lövdal & al. 1958, Dunbar & al. 1968, Helminen-Pakkala 1968) as well as with results obtained from several other countries with a corresponding standard of living (see Russell 1960). The Hailuoto prevalence rates, however, did not agree with the findings of Siirilä & Lindberg (1965) who reported that only 50 % of men aged 25 and women

aged 30 years in Muuruvesi rural community showed clinical signs of gingival inflammation. This discrepancy, as similar discrepancies in general, most likely results from a difference in training and calibration of the investigators. The dental investigation of Muuruvesi inhabitants was carried out by a group of dental students with only a brief training in periodontal diagnosis.

The including of retraction into the score 6 of Russell's periodontal index in the present study renders difficult the exact comparison of the severity of periodontal disease in Hailuoto (Table II, Fig. 5) and elsewhere. This modification, however, seemed justified when the effect of periodontal disease rather than the need for therapy was to be determined. The main reason why retraction normally is registered separately from pocket formation is that the former may as well result from vigorous tooth brushing as from intermittent pocket formation and healing periods (*Waerhaug* 1968). Vigorous tooth brushing, however, is especially among older present day Finnish rural inhabitants a most unusual practice. The index modification should be born in mind when observing that the pooled *PI* curve in Fig. 5 lies somewhere inbetween corresponding curves obtained from western countries and that registered by *Waerhaug* (1967) in his Ceylon material. The general trend of the curve as well as its linear correlation through age with the oral hygiene level, however, agrees with the great majority of earlier reports (*Helminen-Pakkala* 1968).

*Marshall-Day & al.* (1955) reported a significant reduction of incidence of gingival disease from 80 % to 62 % from the age 13—15 years to the late teens and early twenties. This improvement of periodontal conditions was particularly marked in females. In the present study a corresponding improvement was observed in the *PI* score of girls (Table II) and in the debris indexes of both sexes (Table II, Fig. 2). Whether these better conditions are due to a hormonally controlled change in the rate of or resistance to plaque formation after puberty or whether they should be attributed to an increased interest towards oral cleanliness in the late teens, is open to speculation.

Females in Hailuoto showed better periodontal conditions than males (Table II, Fig. 4.). This finding confirms earlier observations from Finland (*Sirilä & Lindberg* 1965, *Helminen-Pakkala* 1968) as well as from several other wealthy western countries (*cf. Helminen-Pakkala* 1968). The sex differences in Hailuoto seemed to derive primarily from the better tooth cleansing efficiency of females than males (Fig. 2) which subsequently leads to less calculus formation (Fig. 3) and to less severe periodontal involvements. That no true sex difference exists was suggested by *Arno & al.* (1958), who found similar incidences of gingivitis in males and females of the same occupation, smoking habits, age and oral hygiene. *Waerhaug* (1967), on the

other hand, found males in Ceylon to have better periodontal conditions than females. This reverse relationship was assumed to result from the lowered resistance towards gingival infection of the Far East woman, who lives close to starvation and furthermore is either pregnant or lactating during most of her adult life.

The sex difference found in the present study may, however, as suggested by *Helminen-Pakkala* (1968), also be an indirect consequence of the higher frequency of tooth loss in the female than in the male Hailuoto population (Table I, Fig. 1). Extensive tooth loss at an early age indicates a high caries activity. As its prevalence in Hailuoto has not yet been analysed, it is not possible to assess whether caries to such an extent would attack females selectively. It seems, however, evident that a strive for a better esthetic appearance activates females more often than males to substitute their deficient teeth with prosthetic restorations. In the relatively poor Finnish rural communities this mostly results in total extractions and insertion of full upper or full upper and lower dentures. As neglected dentitions are the first to become deficient and extracted, the mean oral cleanliness of the remaining dentitions in an age group will thus automatically improve. This was seen in the present material in adult females in general and also in the male age group 40—49 years in which an abrupt increase in frequency of missing teeth (Fig. 1) corresponded to a mean decrease of the amount of oral debris (Fig. 2).

The extensive tooth loss in older age groups motivated *Schei & al.* (1959) to limit their study on marginal bone loss in male employees of the Oslo industrial plant to men under 45 years of age only. Such a practice may seem justified as older age groups offer no information on those teeth which are lost because of periodontal disease. It must also be remembered, whenever the periodontal conditions of old persons are compared with those of teenagers and young adults, that these age groups represent two separate generations with perhaps different predisposition to periodontal destruction. On the other hand, old age groups are the ones who suffer most from periodontal disease, and it seems thus essential to include them in epidemiological studies. The present study showed that the cumulation of dental calculus (Fig. 3) as well as the increase of both prevalence (Fig. 4) and severity (Table II, Fig. 5) of periodontal disease continued to impair the periodontal conditions of the few remaining measurable dentitions presented by the old representatives of the Hailuoto population.

#### Acknowledgement

The authors are indebted to Emil Aaltosen Säätiö for financial support and to Dr. Hilikka Brusii, Head of the Department of Periodontology, Institute of Dentistry, University of Turku, for her valuable assistance in the calibration of the examiner.

## SUMMARY

The periodontal conditions of 528 12 year old and older inhabitants of the island Hailuoto were examined. Measurable dentitions were found in a total of 115 the females (42 %) and 143 of the males (57 %). Signs of gingival inflammation were presented by 80—100 % of the girls and boys in puberty and in their late teens. Gingivitis ( $PI = 0.01—2.0$ ) was found more frequently in girls than in boys whereas periodontal breakdown ( $PI = 2.01$  and over) occurred earlier and more often in males than in females. A temporary decrease of the mean  $PI$  score was registered in girls after puberty. Loss of tooth attachment was registered in both sexes starting from age 16—19 years and its frequency reached 100 % in males aged 40 and in females aged 50 years and over.

In general, females showed better periodontal conditions ( $PI$ ,  $DI-S$ ,  $CI-S$  and  $OHI-S$ ) than males. This finding was suggested to result not only from the superior quality of female oral hygiene but also from the fact that females more often than males have their esthetically deficient dentitions totally extracted and replaced by removable dentures. The dentitions first to encounter such therapy were suggested to be those most neglected as to their hygiene.

In spite of the strong selection of the material through an unusually high frequency of total tooth loss, also the periodontal conditions of the few remaining measurable dentitions of old Hailuoto inhabitants showed continuous deterioration with advancing age.

## RESUME

## ETAT DU PARODONTE DANS UNE POPULATION RURALE FINLANDAISE

Une étude a été effectuée sur l'état du parodonte de 528 habitants de l'île de Hailuoto, âgés de 12 ans et plus. Chez au total 115 des sujets du sexe féminin (42 %) et 143 des sujets du sexe masculin (57 %), on a trouvé des dentures susceptibles d'être mesurées. Chez 80—100 % des filles et des garçons à l'âge de la puberté et approchant de la vingtaine, on a trouvé des signes d'inflammation gingivale. La gingivite ( $PI = 0,01—2,0$ ) a été trouvée plus fréquemment chez les filles que chez les garçons, tandis que l'atteinte du parodonte ( $PI = 2,01$  et plus) se faisait plus tôt et plus souvent chez les sujets de sexe masculin que chez ceux du sexe féminin. Une diminution temporaire des valeurs moyennes du  $PI$  a été enregistrée chez les filles après la puberté. On enregistrait la perte de l'attachement dentaire dans les deux sexes à partir de l'âge de 16—19 ans et la fréquence atteignait 100 % chez les hommes de 40 ans et chez les femmes de 50 ans et plus.

Dans l'ensemble, l'état du parodonte (PI, DI-S, CI-S et OHI-S) était meilleur pour le sexe féminin que pour le sexe masculin. Il semble que cela ne résulterait pas seulement de la meilleure qualité de l'hygiène bucco-dentaire des femmes, mais aussi du fait que les femmes, plus souvent que les hommes, lorsque leur denture est déficiente du point de vue esthétique, font extraire toutes leurs dents et les font remplacer par une prothèse amovible. Les dentures subissant d'abord ce sort seraient probablement celles dont l'hygiène a été le plus négligée.

Bien que la fréquence inhabituellement élevée des cas de perte totale des dents assure un fort degré de sélection du matériel, l'état du parodonte du petit nombre de dentures susceptibles d'être mesurées existant encore chez les habitants âgés de Hailuoto montre aussi une destruction progressant continuellement avec l'âge.

#### ZUSAMMENFASSUNG

##### ZUSTAND DES PARODONTIUMS IN EINE FINNISCHE LANDBEVÖLKERUNG

Während der Untersuchung wurde der Zustand des Zahnbettes bei 528 Einwohnern — alle über 12 Jahre — der Hailuoto Insel registriert. Zu registrierende Gebisse gab es bei 155 der Frauen (42 %) und 143 der Männer (57 %). In Altersgruppen unter 20 Jahre wurde bei 80—100 % der Mädchen und Jungen Gingivitis festgestellt. Im allgemeinen waren Zahnfleischentzündungen ( $PI = 0,01-2,0$ ) bei Mädchen häufiger als bei Jungen, während anhaltende Beschädigungen des Parodontiums bei Männern früher und häufiger auftraten als bei Frauen. Nur bei Mädchen nach der Pubertät wurde eine zufällige Besserung im parodontalen Zustand mit dem Alter festgestellt. Beschädigungen des Halteapparates der Zähne wurden bei beiden Geschlechtern vom 16 Lebensjahr an registriert und die Beschädigungsfrequenz erreichte 100 % bei Männern mit dem 40. und bei Frauen mit dem 50. Lebensjahr.

Im allgemeinen hatten die Frauen einen besseren parodontalen Status (PI, DI-S, CI-S und OHI-S). Vermutlich hat dieser Vorrang seinen Ursprung nicht nur in der besseren Hygiene der Frauen, sondern auch in der Tatsache, dass die Frauen aus ästhetischen Gründen eher geneigt sind, ihre fehlenden Zähne mit Prothesen ersetzen zu lassen. In dieser Weise fallen aus dem Material die durchschnittlich schlechtesten Gebisse aus.

Ungeachtet der Tatsache, dass das Ausfallen der zu messenden Gebisse in Hailuoto ungewöhnlich auffallend war und das Material deswegen mit dem Alter immer mehr selektiv wurde, erwies sich, dass der Zustand des Parodontiums sich immer mit dem Alter verschlechterte.

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