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Trends in periodontal health among 35-year-olds in Oslo, 1973–2003

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Abstract

Aim: The aim of the present study was to describe trends in periodontal health and oral hygiene using data available from four epidemiological studies on 35-year-olds in Oslo performed from 1973 to 2003.

Material and Methods: Periodontal status of randomly selected 35-year-olds was assessed clinically and radiographically. Clinical registrations were based on the Community Periodontal Index of Treatment Needs (CPITN) and the Simplified Oral Hygiene Index. In addition, the proportion of individuals with marginal bone loss was assessed using available orthopantomograms.

Results: The proportion of persons with CPITN score 4 (one or more pockets $\geqslant$6 mm) decreased from 21.8% in 1984 to 8.1% in 2003. In addition, the mean number of sextants with deep pockets per person was considerably lower in 2003 than previously. The proportion of persons without recorded bone loss increased from 46% in 1973 to 76% in 2003. An improvement in oral hygiene scores was also observed during this period.

Conclusions: The results suggest that periodontal health and oral hygiene have been improving among 35-year-olds in Oslo during the last 30 years.

Key words: adults; CPITN; epidemiology; marginal bone loss; trends

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While changes in dental caries prevalence during the past 30 years have been extensively documented, there is less available evidence for trends in periodontal health (Page 1995, Papapanou & Lindhe 2003).

In a recent review on epidemiology of periodontal diseases in Europe, Sheiham & Netuveli (2002) concluded that periodontal health in Europe seemed to be improving. They reported that the prevalence of advanced periodontal disease measured by Community Periodontal Index of Treatment Needs (CPITN) in European adults was low. The proportion of 35–44-year-olds with deep periodontal pockets (6 mm or deeper) was below 10% in many West European countries and the proportion of persons with shallow pockets (4–5 mm) ranged from 13% to 54%. The majority of studies referred to in the review were from the 1980s.

There are few studies that have reported time trends in periodontal diseases among adults. In the studies from Jönköping, Sweden, Hugoson et al. (2005) described changes in periodontal conditions among 15–80-year-olds based on four repetitive cross-sectional studies from 1973 to 2003. The authors reported that in 2003, the marginal bone level at the age of 60 years corresponded to the marginal bone level at the age of 40 years in 1973. The percentage of individuals with one or more periodontal pockets $\geqslant$4 mm was of the same magnitude in 1973 and 2003, i.e. among the 30-year-olds 56% had one or more periodontal pocket $\geqslant$4 mm in 1973 compared with 47% in 2003. There was a 50% reduction in the occurrence of plaque and gingivitis in 2003, compared with 1973. Similarly, in a Dutch study on trends in periodontal status between 1983 and 1995, Kalsbeek et al. (2000) described improvement in periodontal conditions by means of less teeth affected by plaque, calculus, gingival bleeding and exposure of buccal roots. However, there were no changes observed in percentage of persons with pockets $>$5 mm. The improvement in periodontal conditions among Finnish conscripts from 1976 to 1991 has been

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reported by Ankkuriniemi & Ainamo (1997), indicating reduced percentages of subjects affected with dental plaque, subgingival calculus and one or more 4 mm or deeper pockets. However, the levels of supragingival calculus and the gingival bleeding remained at the same level during the 15-year period. A decrease in the overall prevalence of periodontitis from 1988 to 2000 has also been reported from the United States (Borrell et al. 2005).

It seems that several of the time-trend studies report improvements in gingivitis and mild/moderate periodontitis, without clear indications of a reduction in the proportion of the populations suffering from the severe forms of periodontitis (Gjermo 2005).

Comparisons of different epidemiological studies are difficult due to lack of consistency in the definition of periodontal disease parameters and use of measurement criteria. The parameters most frequently assessed are gingival bleeding, probing pocket depth, loss of attachment and radiographic bone loss. However, the use of these parameters varies in different studies. There are also considerable variations in the number of sites per tooth and the number of teeth examined (Kingman & Albandar 2002). Inconsistencies in the methodology and disease parameters measured influence the findings and limit valid comparisons between the different studies.

Four repetitive cross-sectional oral health studies have been performed in Oslo from 1973 to 2003 revealing trends in dental health among 35-year-olds. Changes in periodontal indicators from 1973 to 1984 were assessed by the Periodontal Treatment Need System (PTNS) (Johansen et al. 1973) and are described by Hansen et al. (1990). The study reported marked reduction in the prevalence and extent of severe periodontitis (PTNS score C). Further trends in periodontal health in this group have not been investigated.

The aim of the present study was to describe time trends in periodontal health and oral hygiene conditions using data available from four repeated cross-sectional epidemiological studies performed among 35-year-olds in Oslo from 1973 to 2003.

Material and Methods

Four repetitive random samples of 35-year-olds in Oslo in 1973, 1984, 1993 and 2003 are the basis for this study. Details about the sampling procedures have been described in previous publications (Hansen & Johansen 1976, Bjertness et al. 1986, Berset et al. 1996, Skudutyte-Rysstad & Eriksen 2007). Approval for performing the 1993 and 2003 studies was obtained from the Regional Committee for Medical Research Ethics, Norway.

Table 1. Number of participants, response rates and socio-demographic characteristics of participants according to the year of study

Year of study	Number of participants (response rate)	Gender		Region of birth		
		male	female	Norway	western countries	non-western countries
1973	117 (66%)	60 (51%)	57 (49%)	111 (95 %)	5 (4 %)	1 (1 %)
1984	156 (80%)	78 (50%)	78 (50%)	136 (87 %)	8 (5 %)	12 (8 %)
1993	121 (68%)	55 (45%)	66 (55%)	105 (87%)	7 (6 %)	9 (7 %)
2003	149 (64%)	89 (60%)	60 (40%)	111 (75 %)	15 (10 %)	23 (15 %)

The number of participants and response rates in each of the studies are presented in Table 1.

The clinical and radiographic examinations were performed at the Dental Faculty, University of Oslo. Before the examination, the participants completed a structured questionnaire on socio-demographic characteristics and dentist visiting habits. The questionnaire data are not presented in this study, except for the evaluation of the non-attendance. In 1984, 1993, and 2003, clinical registrations of periodontal status were based on the CPITN using the CPITN probe and recordings from index teeth and the participants were then classified according to the highest CPITN score per person (Ainamo et al. 1982). As mentioned above, changes from 1973 to 1984 assessed by PTNS have been described previously (Hansen et al. 1990).

Clinical examinations were performed by three different dentists, who were calibrated with the same periodontist regarding the diagnostic criteria before the examination. Double examination of 36 sextants in six participants was performed in order to assess intra-examiner reliability in 2003. The κ value for intra-observer agreement was 0.73.

Oral hygiene of participants was assessed by the Simplified Oral Hygiene Index (OHI-S) (Greene & Vermillion 1964).

Orthopantomograms from 83 (71%) of the participants in 1973, 115 (74%) participants in 1984, 117 (97%) participants in 1993, and 138 (93%) in 2003 were available for the assessment of radiographic bone loss. Marginal bone level was assessed with a transparent plastic ruler using light board illumination and a measurement technique as described by Schei et al. (1959). According to this technique, the alveolar bone height was measured separately on the mesial and distal surface of each tooth in relation to the radiographic root length. The root apex and cemento-enamel junction (CEJ) were used as reference points. In the present study, the ruler was slightly modified by choosing the optimal distance from the alveolar crest to CEJ as 2 mm or less, compared with 1 mm as originally described by Schei et al. (1959). Bone loss was considered to be present in sites where the distance from alveolar crest to CEJ exceeded 2 mm and measured to the nearest 10%. The participants were then categorized according to the highest bone loss score recorded at one or more sites. The measurements were carried out by two different examiners, where examiner one assessed orthopantomograms from 1973 to 1993 and examiner two assessed the 2003 study. Inter-observer agreement was assessed by duplicate recordings of 10 randomly selected orthopantomograms by both examiners. The κ value for inter-observer agreement was 0.93. In addition, intra-observer agreement of the second examiner (2003 study) was assessed by duplicate examination of 12 radiographs. The κ value for intra-observer agreement was 0.93.

Data were computerized and analysed by the SPSS statistical program package (SPSS for Windows 13.0, SPSS Inc., Chicago, IL, USA). Differences in the proportion of persons according to their highest CPITN score and differences in the proportion of subjects within different categories of radiographic bone loss were assessed by the χ^2 test. ANOVA with Tukey's adjustment were used to assess differences in the mean number of sextants scored with different CPITN scores and differences in the

OHI-S scores. The significance level was set at 0.05.

Results

Changes in CPITN

The periodontal health conditions for the years 1984, 1993, and 2003 measured as the percentages of persons according to their highest CPITN score are presented in Fig. 1. The proportion of individuals with Code 4 (one or more periodontal pockets 6 mm or deeper) decreased significantly from 21.8% in 1984 to 8.1% in 2003 ($p = 0.003$). Owing to the fact that there was an increase in the proportion of participants who scored Code 3 (4–5 mm pockets), the total proportion of persons affected by periodontal pockets (Codes 3 and 4) decreased to a lesser extent from 73.1% in 1984 to 66.5% in 2003 ($p = 0.005$). The proportion of individuals with all sextants scored CPITN Code 0 remained unchanged during this 20-year period. Nevertheless, there was more than a threefold increase in the mean number of sextants scored Code 0 per person from 1984 to 2003 ($p = 0.000$) (Table 2). In addition, the mean number of sextants scored with deep pockets was significantly lower in 2003 compared with 1984 ($p = 0.003$).

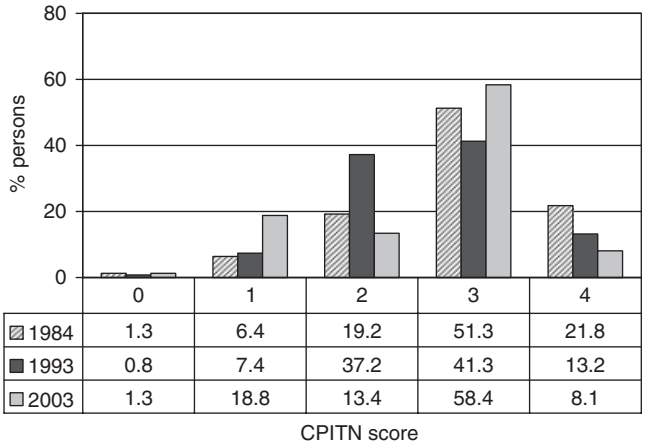

Fig. 1. Percentage distributions of participants according to the highest Community Periodontal Index of Treatment Needs (CPITN) score per person, 1984–2003.

Table 2. The mean number of sextants with different CPITN scores per person, 1984–2003

Year of survey	The mean (SD) number of sextants with different CPITN scores					
	0	1	2	3	4	excluded
1984 ($n = 156$)	0.33 (0.92)*	1.88 (1.74)*	1.60 (1.51)	1.62 (1.48)*	0.49 (1.21)	0.07 (0.38)*,†
1993 ($n = 121$)	0.54 (1.30)*	3.00 (1.84)	1.09 (1.07)	1.15 (1.41)	0.21 (0.59)‡	0.02 (0.18)*,§
2003 ($n = 149$)	1.29 (1.39)	2.24 (1.55)*	0.66 (0.86)	1.64 (1.54)*	0.16 (0.64)‡	0.01 (0.12)†,§

Within columns, means sharing the same symbol (*,§ or †) are not significantly different.
CPITN, Community Periodontal Index of Treatment Needs.

Table 3. Differences in the mean OHI-S, DI-S, and CI-S scores, 1973–2003

Year of survey	Oral hygiene mean (SD)		
	OHI-S	DI-S	CI-S
1973 ($n = 116$)	1.55 (0.97)*	0.84 (0.44)*	0.72 (0.67)*
1984 ($n = 156$)	1.64 (1.10)*	0.91 (0.41)*	0.73 (0.78)*
1993 ($n = 121$)	0.64 (0.50)‡	0.56 (0.39)	0.08 (0.20)†
2003 ($n = 149$)	0.48 (0.43)‡	0.34 (0.29)	0.14 (0.23)†

Within columns, means sharing the same symbol (* or †) are not significantly different.
CI-S, calculus index; DI-S, debris index; OHI-S, Simplified Oral Hygiene Index.

Changes in oral hygiene

The assessment of oral hygiene according to the OHI-S is presented in Table 3. When the entire 30-year period is considered, there has been a statistically significant reduction in both calculus and plaque scores, indicating that oral hygiene improved substantially. As shown in Fig. 2, a shift towards lower OHI-S scores occurred in 1993. Although there was a further decrease in OHI-S score observed between 1993 and 2003, the reduction was minor and not statistically significant.

Changes in radiographic marginal bone level

Percentage distributions of participants categorized according to the level of radiographic bone loss are presented in Fig. 3. The proportion of individuals without recorded bone loss increased significantly from 46% in 1973 to 76% in 2003 ($p = 0.000$). The proportion of participants with 20% bone loss or greater also decreased substantially during this 30-year period ($p = 0.006$). In addition, a statistically significant reduction by half in the proportion of participants with up to 10% bone loss has occurred during the last decade ($p = 0.011$).

Discussion

This study is based on data from four repeated cross-sectional studies performed among randomly selected 35-year-olds in Oslo. By repeatedly examining a specific age group at three different points in time, it was possible to see trends in the periodontal health condition in this group over time.

The results indicate a periodontal health improvement among 35-year-olds in Oslo during the past 30 years. In addition to a substantial increase in the proportion of individuals without radiographically recorded bone loss, a reduction in the proportions of persons with clinically and radiographically recorded advanced periodontal destruction has been observed during this period.

The response rate in the studies varied between 64% and 80% and attempts were therefore made to detect possible bias due to non-attendance. In all the four studies, the non-attenders were contacted in order to find out the reasons for non-attendance, socio-demographic characteristics, and dentist visiting habits (data available for 1984–2003). From available information about the

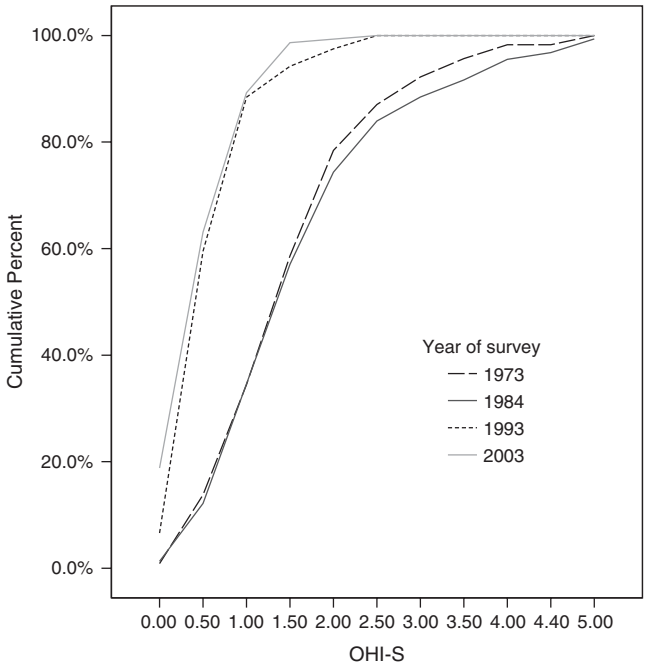

Fig. 2. Cumulative percentage distributions of participants according to Simplified Oral Hygiene Index (OHI-S) scores, 1973–2003.

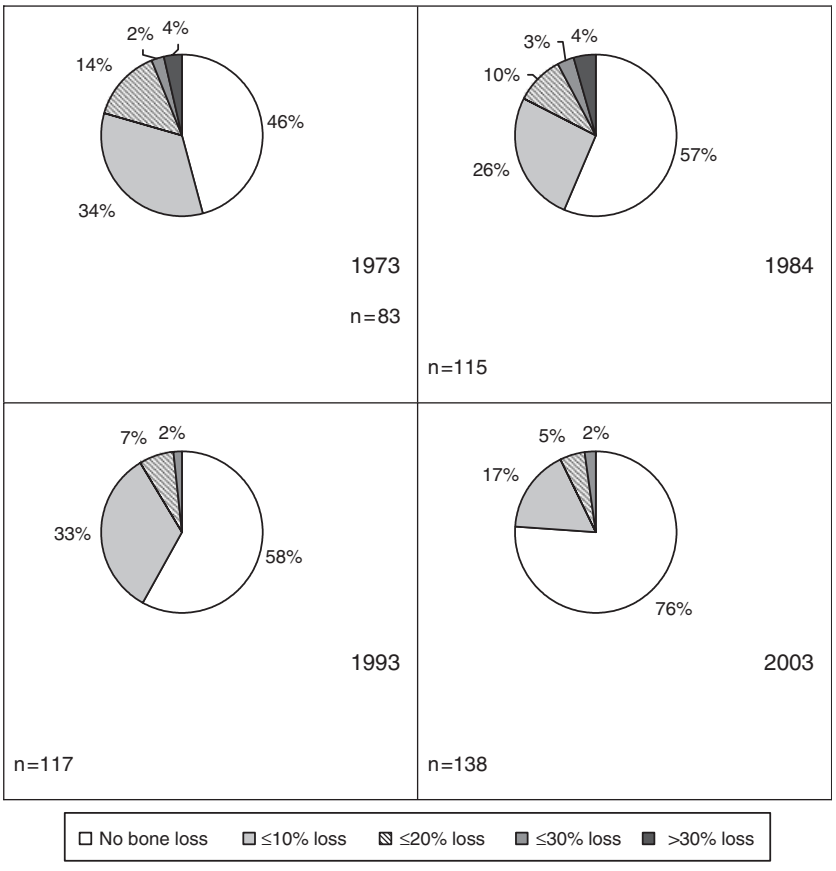

Fig. 3. Percentage distribution of participants according to the level of marginal bone loss measured from orthopantomograms in 1973–2003.

non-attenders in the 1984 and 1993 studies, no substantial systematic differences in dental conditions or dental health-related habits between attenders and non-attenders were detected (Bjertness et al. 1986, Berset et al. 1996). In addition to slight differences in dentist visiting habits among participants and non-attenders in the 2003 study, there was a higher proportion of women and twice as many smokers among the non-attenders (Skudutyte-Rysstad & Eriksen 2007). Compared with the general population of 35-year-olds in Oslo, persons with higher education were overrepresented among the study participants. These differences cannot exclude the possibility that periodontal conditions among the participants in 2003 were slightly better than in the general population.

Substantial changes in the demographic composition of 35-year-olds have occurred during the 30-year period in Oslo (Table 1). Owing to the increased population mobility, the proportion of non-western immigrants in Oslo increased from 1% in 1973 to 15% in 2003. Because the proportion of individuals with CPITN 4 (deep periodontal pockets) was substantially higher in this group compared with the rest of the participants (75% in 1984, 33% in 1993, and 30% in 2003), this probably had an impact on changes observed over time.

Although it is likely that similar changes in periodontal conditions could be observed among adults in Norway, the generalizability of the results in the present study is restricted to the Oslo population.

Both clinical and radiographic parameters were used for assessment of periodontal conditions. The clinical data, based on the CPITN, were available for the period 1984–2003. The index was first introduced in 1982 (Ainamo et al. 1982) for assessing treatment needs, but later it has been widely used in recording periodontal status despite several methodological limitations (Papapanou & Lindhe 2003). Although the CPITN was chosen for recording periodontal disease indicators for comparative purposes in the present study, the use of the index offered limited validity in the interpretation of results.

The index parameters include all periodontal disease indicators from bleeding on probing to advanced periodontal disease at one or more sites and do not make a distinction between gingival inflammation and periodontal destruction. This is because the

hierarchical scoring principle of the index implies a predictable continuous progression from marginal gingival inflammation to periodontitis, reflecting an outdated concept in the pathogenesis of periodontal disease. However, CPITN scores 1 and 2 primarily reflect gingival inflammation and poor oral hygiene, conditions that are relatively common and do not necessarily progress to periodontitis. Gingivitis may even be regarded as a normal physiologic response to noxious agents normally found in the dental biofilm and not a disease (Gjermo 2005).

Another shortcoming of the index is that measures of clinical attachment loss are not recorded. Moreover, the use of the index teeth instead of full-mouth recordings may result in underestimation of the prevalence of periodontal pockets and discrepancies in recording the severity of disease (Baelum et al. 1993, Benigeri et al. 2000).

The clinical examinations of participants were performed by three different examiners calibrated with the same periodontist with regard to the registration criteria. However, due to the 20-year interval between the clinical examinations, the possibility of variation in clinical diagnosis cannot be ruled out.

In addition to the clinical assessment of periodontal conditions, measurements of marginal bone loss were performed on orthopantomograms available from all the four studies. Despite the higher proportion of immeasurable sites assessing marginal bone level from panoramic radiographs compared with full-mouth surveys, several studies have shown good consistency between intraoral and panoramic radiographs in assessing marginal bone loss (Ahlqwist et al. 1986, Rohlin et al. 1989, Åkesson et al. 1989b, Persson et al. 2003). The proportion of non-measurable sites varied from 25% to 27.5% in the different study years and it is a limitation that could possibly distort estimates of radiographic bone loss. However, the proportion of immeasurable sites was comparable with that found in other studies (Ahlqwist et al. 1986, Åkesson et al. 1989a) and also similar in all the four Oslo investigations.

Both clinical and radiographic parameters indicate that there has been an improvement in periodontal health among 35-year-olds in Oslo. There has been a decrease in both the proportion of persons with CPITN 4 and the mean number of sextants with CPITN 4 per person. A reduced prevalence of severe periodontitis measured by PTNS in this population from 1973 to 1984 has been reported earlier by Hansen et al. (1990). Although the results are not directly comparable because different index systems were used, there are indications that the proportion of subjects with severe periodontal destruction has been declining during all the three decades. An increase in the mean number of healthy sextants per person in 2003 compared with the earlier investigations could be another indication of improvement.

At the same time, the proportion of participants without radiographically registered bone loss has almost doubled during the three decades and the proportions of individuals with severe radiographic bone loss have gradually declined. Although recording of periodontal conditions at the individual level according to the most severe condition gives relatively crude estimates of periodontal status, the observed changes reflect an improvement that occurred during this 30-year period. All the described changes occurred in addition to the fact that the mean number of missing teeth decreased from 2.8 in 1973 to 0.7 in 2003 (Skudutyte-Rysstad & Eriksen 2007).

The findings of the present study support the results of several other studies on trends in periodontal conditions (Ankkuriniemi & Ainamo 1997, Kalsbeek et al. 2000, Hugoson et al. 2005). However, as mentioned previously, due to the inconsistency in the registration criteria used, direct comparisons are difficult. An increase in the number of individuals without alveolar bone loss and a decrease in the number of individuals with moderate periodontal bone loss in 30- and 40-year-old individuals from 1973 to 1993 has been reported from three repeated cross-sectional studies from Sweden (Hugoson et al. 1998). In the more recent report on periodontal conditions (Hugoson et al. 2005), the authors reported that the frequency of subjects with periodontal pockets $\geqslant 4$ mm decreased only slightly during the whole 30-year period. This is in accordance with the findings of the present study where the reduction in the total proportion of persons affected by periodontal pockets $\geqslant 4$ mm, corresponding CPITN scores 3 and 4, was about 7%-units.

This study indicates that the prevalence of advanced periodontal destruction among 35-year-olds is about 8%. At the same time, there has been an improvement in periodontal conditions and oral hygiene in this age group during the period 1973–2003. Further studies of disease indicators explaining the observed changes would be of interest and are in progress based on the present data.

References

Ahlqwist, M., Halling, A. & Hollender, L. (1986) Rotational panoramic radiography in epidemiological studies of dental health. Comparison between panoramic radiographs and intraoral full mouth surveys. *Swedish Dental Journal* **10**, 73–84.

Ainamo, J., Barmes, D., Beagrie, G., Cutress, T., Martin, J. & Sardo-Infirri, J. (1982) Development of the World Health Organization (WHO) Community Periodontal Index of Treatment Needs (CPITN). *International Dental Journal* **32**, 281–291.

Åkesson, L., Rohlin, M. & Håkansson, J. (1989a) Marginal bone in periodontal disease: an evaluation of image quality in panoramic and intra-oral radiography. *Dento-Maxillo-Facial Radiology* **18**, 105–112.

Åkesson, L., Rohlin, M., Håkansson, J., Håkansson, H. & Nasström, K. (1989b) Comparison between panoramic and posterior bitewing radiography in the diagnosis of periodontal bone loss. *Journal of Dentistry* **17**, 266–271.

Ankkuriniemi, O. & Ainamo, J. (1997) Dental health and dental treatment needs among recruits of the Finnish defence forces, 1919–91. *Acta Odontologica Scandinavica* **55**, 192–197.

Baelum, V., Fejerskov, O., Manji, F. & Wanzala, P. (1993) Influence of CPITN partial recordings on estimates of prevalence and severity of various periodontal conditions in adults. *Community Dentistry and Oral Epidemiology* **21**, 354–359.

Benigeri, M., Brodeur, J. M., Payette, M., Charbonneau, A. & Ismail, A. I. (2000) Community periodontal index of treatment needs and prevalence of periodontal conditions. *Journal of Clinical Periodontology* **27**, 308–312.

Berset, G. P., Eriksen, H. M., Bjertness, E. & Hansen, B. F. (1996) Caries experience of 35-year-old Oslo residents and changes over a 20-year period. *Community Dental Health* **13**, 238–244.

Bjertness, E., Eriksen, H. M. & Hansen, B. F. (1986) Caries prevalence of 35-year-old Oslo citizens in 1973 and 1984. *Community Dentistry and Oral Epidemiology* **14**, 277–282.

Borrell, L. N., Burt, B. A. & Taylor, G. W. (2005) Prevalence and Trends in Periodontitis in the USA: the NHANES, 1988 to 2000. *Journal of Dental Research* **84**, 924–930.

Gjermo, P. E. (2005) Impact of periodontal preventive programmes on the data from

epidemiologic studies. *Journal of Clinical Periodontology* **32**, 294–300.

Greene, J. C. & Vermillion, J. R. (1964) The simplified oral hygiene index. *Journal of the American Dental Association* **68**, 7–13.

Hansen, B. F., Bjertness, E. & Gjermo, P. (1990) Changes in periodontal disease indicators in 35-year-old Oslo citizens from 1973 to 1984. *Journal of Clinical Periodontology* **17**, 249–254.

Hansen, B. F. & Johansen, J. R. (1976) Dental visits, teeth remaining, and prosthetic appliances in a Norwegian urban population. *Community Dentistry and Oral Epidemiology* **4**, 176–181.

Hugoson, A., Koch, G., Göthberg, C., Helkimo, A. N., Lundin, S. A., Norderyd, O., Sjödin, B. & Sondell, K. (2005) Oral health of individuals aged 3–80 years in Jönköping, Sweden during 30 years (1973–2003). II. Review of clinical and radiographic findings. *Swedish Dental Journal* **29**, 139–155.

Hugoson, A., Norderyd, O., Slotte, C. & Thorstensson, H. (1998) Distribution of periodontal disease in a Swedish adult population 1973, 1983 and 1993. *Journal of Clinical Periodontology* **25**, 542–548.

Johansen, J. R., Gjermo, P. & Bellini, H. T. (1973) A system to classify the need for periodontal treatment. *Acta Odontologica Scandinavica* **31**, 297–305.

Kalsbeek, H., Truin, G. J., Poorterman, J. H., van Rossum, G. M., van Rijkom, H. M. & Verrips, G. H. (2000) Trends in periodontal status and oral hygiene habits in Dutch adults between 1983 and 1995. *Community Dentistry and Oral Epidemiology* **28**, 112–118.

Kingman, A. & Albandar, J. M. (2002) Methodological aspects of epidemiological studies of periodontal diseases. *Periodontology 2000* **29**, 11–30.

Page, R. C. (1995) Critical issues in periodontal research. *Journal of Dental Research* **74**, 1118–1128.

Papapanou, P. N. & Lindhe, J. (2003) Epidemiology of periodontal diseases. In: Lindhe, J., Lang, N. P. & Karring, K. (eds). *Clinical Periodontology and Implant Dentistry*, 4th edition, pp. 50–80. Oxford: Blackwell Munksgaard.

Persson, R. E., Tzannetou, S., Feloutzis, A. G., Bragger, U., Persson, G. R. & Lang, N. P. (2003) Comparison between panoramic and intra-oral radiographs for the assessment of alveolar bone levels in a periodontal maintenance population. *Journal of Clinical Periodontology* **30**, 833–839.

Rohlin, M., Åkesson, L., Håkansson, J., Håkansson, H. & Nasström, K. (1989) Comparison between panoramic and periapical radiography in the diagnosis of periodontal bone loss. *Dento-Maxillo-Facial Radiology* **18**, 72–76.

Schei, O., Waærhaug, J., Lovdal, A. & Arno, A. (1959) Alveolar bone loss as related to oral hygiene and age. *Journal of Periodontology* **30**, 7–16.

Sheiham, A. & Netuveli, G. S. (2002) Periodontal diseases in Europe. *Periodontology 2000* **29**, 104–121.

Skudutyte-Rysstad, R. & Eriksen, H. M. (2007) Changes in caries experience among 35-year-old Oslo citizens, 1973–2003. *Acta Odontologica Scandinavica* **65**, 72–77.

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Clinical Relevance

Scientific rationale for the study: Four cross-sectional epidemiological studies have been performed in 35-year-old Oslo citizens from 1973 to 2003. The present study describes trends in periodontal health and oral hygiene during this period.

Principal findings and practical implications: The proportion of individuals with deep periodontal pockets and proportion of subjects with recorded radiographic bone loss decreased during this period. An improvement in oral hygiene was also observed. The study indicates that the prevalence of advanced periodontal destruction in this age group is about 8%. Further studies addressing possible disease indicators explaining the changes in periodontal conditions during the last 30 years would be of interest.