Changes in dental conditions during a decade in a middle-aged and older Swedish population

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A questionnaire measuring dental conditions was sent to 2708 individuals aged 55–79 years in Örebro County, who about 10 years earlier had been randomly selected for a similar study. The response rate was 68% (1848 individuals). Of those, 1665 had participated also in the 1989 study. The objectives were to study changes in dental conditions having occurred during a decade and to evaluate whether impairment in dental conditions among the participants had resulted in prosthodontic treatments. Only small changes in dental conditions were registered among those who participated both in 1989 and in 1999. Loss of a single tooth was the most frequently reported change. Ten per cent fewer reported that they had all teeth remaining in 1999 compared with conditions in 1989. The number of subjects wearing removable dentures increased only slightly. Although the reported changes in dental conditions were small, there had been a need for prosthodontic treatment in many of the subjects. Ten percent of the subjects reported that they had received FPD treatment during the past 10 years. To conclude, the present study showed that only small changes in dental conditions had occurred among the participants during a decade. Nevertheless, a substantial increase in the prevalence of prosthodontic appliances, especially of fixed restorations, was noted. □ *Dental conditions; prosthodontic treatment; tooth loss*

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Improvement in dental health among the adult population in Sweden has been obvious during the past decades (1–8). Especially the prevalence of edentulousness has decreased dramatically (1–7). Still, many factors such as socio-economic status and demographic attributes are related to variations in dental conditions (1–3, 6, 7, 9).

Longitudinal epidemiological studies of changes in dental conditions among middle-aged and older Swedish citizens are scarce (1, 2, 6, 7). In 1989 the dental conditions among inhabitants aged 45–69 years in Örebro County, Sweden, were studied by means of a questionnaire sent to 3000 randomly sampled subjects (10). About 10 years later the study was repeated. A new questionnaire was sent to the same individuals if found in the national population register. The objectives of the present paper were 1) to collect information about the changes in dental conditions which had occurred during a decade in the subjects, who were now 55–79 years old, and 2) to evaluate whether impairment in dental conditions among the participants had resulted in prosthodontic treatments.

Materials and methods

In the study performed in 1989, 3000 randomly selected individuals aged 45–69 years in Örebro County were included. The response rate was 79.4% (2383 individuals). Of the original sample, 2708 respondents were found in the national population register 10 years later, on the basis of the criteria that they were alive and still had residence in Örebro County. A new questionnaire was sent to all 2708 individuals. The number of respondents was 1848, yielding a response rate of 68%. Among those, 1665 had responded both in 1989 and 1999. The subjects who responded in both 1989 and 1999 were, compared with those who responded only in 1989, younger and better educated and had better dental status—that is, fewer wore a removable denture (Table 1). Income was also found to be a significant variable but was not included in the model because of high internal non-response. The variables used have been published earlier (10).

The questionnaires used in 1989 and in 1999 contained the same questions (10). In addition, a few new questions were added in the 1999 questionnaire about the number of lost teeth, prosthodontic treatments, and various complications having occurred since the previous study. The same routines as in the 1989 study were used: the subjects were requested to fill out the form and return it as soon as possible. Those who had not responded within 3 weeks received a reminder. Those who had still not responded in another couple of weeks were sent another reminder together with a questionnaire form. After that, no further attempt was made to get responses to the questionnaire.

In the questionnaire the following options aimed at measuring dental conditions: a) 'all my teeth are remaining'; b) 'I have one or two single teeth missing and not replaced'; c) 'I have several teeth missing and not

Table 1. A logistic regression analysis with participation also in the 1999 study versus participation only in the 1989 study as the dependent variable. b values are given, as are odds ratios (OR) with 95% confidence intervals

Independent variable	b	OR	95% conf. int.
Sex, female (male = ref.cat.)	0.0986	1.10	0.91–1.29
Age (continuous variable)	−0.0361	0.96	0.95–0.97
Education, middle or long education (short education = ref.cat.)	0.5336	1.71	1.46–1.96
Dental conditions, wearing removable denture(s) (no removable denture = ref.cat.)	−0.9258	0.40	0.19–0.61

Model chi-square, 192.6, 4 df, $P \leq 0.001$. 72.2% correctly classified.

replaced'; d) 'all my teeth are missing, but I wear no denture'; e) 'I have fixed partial denture(s) '; f) 'I wear an implant-supported prosthesis'; g) 'I wear a removable partial denture'; and h) 'I wear a complete removable denture'. There were separate answers for the maxilla and the mandible, and the subjects were instructed to mark as many alternatives as they found correct.

The subjects were assigned to one of seven dental categories, the same as used in the 1989 study (10): 1) all teeth remaining; 2) all missing teeth replaced by fixed prosthodontics (no missing tooth not replaced, no removable denture); 3) one or two single teeth missing and not replaced (fixed partial denture(s) may be present as well but not removable denture); 4) several teeth missing and not replaced (fixed partial denture(s) may be present as well but not removable denture); 5) wearing removable partial denture(s) (might have fixed prosthesis as well, not totally edentulous in any jaw); 6) totally edentulous in one jaw (but not in both jaws); and 7) totally edentulous in both jaws.

The prevalence measure of various types of fixed and removable dentures included conventional fixed partial dentures (FPD), implant-supported prostheses, removable partial dentures (RPD), and removable complete dentures. Separate answers were given for the maxilla and the mandible.

One question aimed at changes in dental status, various complications, and prosthodontic treatments: 'Have any of the following incidents occurred during the past 10 years?' The response options were as follows: 1) lost one single tooth; 2) lost a few teeth; 3) lost most of the teeth in one jaw; 4) lost all teeth in one jaw; 5) fractured FPD; 6) received new FPD; 7) received new RPD; 8) received new complete denture; 9) received implant treatment; 10) experienced implant loss; and 11) experienced severe inflammation in the mouth.

Statistical methods

A logistic regression model was used for analyses of response differences between the groups who participated both in the 1989 and the 1999 study and in the 1999 study only. Frequency distributions were calculated for the various measures, and the statistical significance of differences was determined with chi-square tests, with $P < 0.05$ as significance level.

Results

Only small changes in dental conditions were registered among those who participated both in 1989 and in 1999 (Table 2). The most obvious change was a decrease of 10% units for the category 'all teeth remaining' compared with the reported conditions 10 years earlier. A corresponding increase was seen for those who reported one or two single teeth missing and not replaced, whereas the number of subjects wearing removable dentures increased only slightly.

The percentage figures for maxillary and mandibular fixed and removable dentures among all who participated in the 1989 study and for those who participated both in 1989 and 1999 are shown in Table 3. An increase of 6% units for maxillary and mandibular FPDs was reported for those who participated in both studies (Table 3). A considerable increase was seen for the reported number of implant-supported dentures (ISD). For maxillary ISD an

Table 2. Distribution of subjects in seven dental categories. Percentage figures for the conditions in 1989 and 1999. Figures from 1989 for all respondents and separately for those who participated both in 1989 and 1999

Dental categories	Reported category in 1989, all respondents ($n = 2347$)	Reported category in 1989 among those participating in both studies ($n = 1610$)	Reported category in 1999 among those participating in both studies ($n = 1610$)
1. All teeth remaining	24	27	17
2. All missing teeth replaced by fixed prosthodontics	11	11	11
3. One or two single missing teeth and not replaced	27	30	36
4. Several missing teeth and not replaced	14	15	17
5. Wearing removable partial denture(s)	7	6	7
6. Totally edentulous in one jaw	7	5	7
7. Totally edentulous in both jaws	9	5	5

Table 3. Reported number of fixed and removable dentures among all who participated in the 1989 study, reported number of fixed and removable dentures both in 1989 and in 1999 among those who participated in both studies. Percentage figures for the maxilla and the mandible

	Reported category in 1989, all respondents ($n = 2347$)	Reported category in 1989 among those participating in both studies ($n = 1665$)	Reported category in 1999 among those participating in both studies ($n = 1665$)
Maxilla			
Fixed partial denture	21	21	27
Implant supported denture	0.8	1	4
Removable partial denture	5	4	5
Removable complete denture	15	10	11
Mandible			
Fixed partial denture	11	11	17
Implant supported denture	0.5	0.6	3
Removable partial denture	6	5	5
Removable complete denture	9	5	5

almost fourfold higher percentage figure was seen for 1999 compared with 1989, and for mandibular ISD the increase was even higher (Table 3).

Loss of one single tooth was the most reported change in dental conditions during the past 10-year period (Table 4). Few individuals reported that they had lost most of the teeth or all teeth in one jaw. Ten per cent of the subjects had been receiving new FPDs, and 6% of the subjects had experienced a severe inflammation in the mouth during the 10-year period (Table 4).

Discussion

Of the 1848 individuals who answered the questionnaire in 1989 and were found in the population register 10 years later, 1665 (90%) also answered the new questionnaire. This response rate was satisfactory, although the number of individuals was reduced to 1610 on some variables because of internal non-response (Table 2). When the subjects participating in both 1989 and 1999 were compared with those who had responded only in 1989, there were significant differences between the groups. Those who participated in both studies were, compared with the others, younger, had longer education, and had better dental status according to the registrations in 1989. In this context it should be remembered that individuals with poorer dental conditions have been shown to die earlier than those with better dental status (1).

Table 4. Distribution of reported changes in dental conditions, of new fixed and removable dentures (FPD, RPD) of complications, and of severe oral inflammations during the past 10 years. Percentage figures for the total sample ($n = 1665$)

Type of change	Percentage
1. Lost one single tooth	17
2. Lost a few teeth	6
3. Lost most of the teeth in one jaw	1
4. Lost all teeth in one jaw	1
5. Fractured FPD	6
6. Received new FPD	10
7. Received new RPD	3
8. Received new complete denture	3
9. Received implant treatment	1
10. Implant loss	0.5
11. Experienced severe inflammation in the mouth	6

The main result of the present study was the small change in reported dental status during a decade. There was a decrease in the category with all teeth remaining and an increase in the category with one or two single teeth missing and not replaced. For the other categories none or only small changes were seen. No increase in the percentage of those totally edentulous in both the maxilla and the mandible was found (Table 2). However, the distribution of the non-response should be considered in this context. Generally, the small changes in dental status noted over a 10-year period is in accordance with other reports (6, 11). No similar international comparative studies were, however, found in the literature.

Although changes in dental conditions were low, there had nevertheless been a need for prosthodontic treatment in many of the subjects. Ten per cent of the subjects reported that they had received FPD treatment during the past 10 years (Table 4). Some of them had probably received such treatment because they had lost one tooth or a few teeth, whereas others may have had their old FPDs replaced with new ones because of fractured frameworks or for esthetic reasons. For example, 6% of the subjects reported fracture of an FPD during the past decade.

Treatments with FPDs have shown good long-term results (12–14). More than 60% of the FPDs are reported to survive 20 years (12). Although the longevity has been found to be good, FPDs are not eternal. In a longitudinal study of dental status of middle-aged and older women, Ahlqwist et al. (6) also found that the relative number of artificial crowns and pontics increased significantly with age. It is likely that there will be a substantial need for prosthodontic services in middle-aged and older individuals for many years. Such a need should be met by

society with dental insurance regulations and an insurance system formed with the intention of providing dentistry of high quality to all citizens.

The prognosis for RPD treatment is less favorable than that for FPD treatment (15, 16). In the present study the reported number of treatments with removable dentures was much lower than the figures for FPDs (Table 4). This supports earlier findings of infrequent treatment with removable dentures among general dentists in Sweden (17, 18).

The precision of questionnaire answers on dental conditions is, of course, likely to be inferior to the findings in clinical examinations. However, the subjects participating in the 1989 study were subjected to a validation study (19). High agreement was found between the self-reported and the clinically noted number of missing and replaced teeth and full correspondence for removable dentures. In a study by Unell et al. (20) there was also good correspondence between subjective self-reports and clinical findings, especially for conditions such as number of remaining teeth and presence of dentures (20). Self-assessed data should, however, be used with some caution. For example, in 1989 1.0% reported that they had dental implants in the maxilla. In 1999 the reported prevalence was 3.7% (Table 3), but only 1% reported that they had received dental implants during the past 10 years (Table 4). In a context like the present one, memory will not be totally reliable. Still, only small differences noted in the present study are likely to be caused by memory faults. Moreover, the objective was primarily to study changes. Such data are probably less biased.

To conclude, the present study showed that only small changes in dental conditions had occurred among the participants during a decade. Nevertheless, a substantial increase in the prevalence of prosthodontic appliances, especially of fixed restorations, was noted.

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