The effect of verbal information and demonstration on denture hygiene in elderly people

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The purpose of the present study was to investigate the effect of two oral hygiene information programs on denture hygiene. The programs were provided individually to healthy elderly denture wearers. Totally, 150 edentulous persons between 67 and 89 years of age were selected and randomly assigned to two experimental groups and one control group. In one test group (INFO) the participants were only given individual verbal information on how to remove denture plaque. The participants of the second test group (DEMO) received individual demonstration of denture cleaning in addition. One hundred and thirty-eight persons completed the study. The percentage plaque covering the maxillary denture base was assessed by a morphometric point-estimator scoring method at the start of the study and after 14 and 180 days. Verbal information resulted only in a short-term effect (14 days), whereas demonstration on how to remove denture plaque gave long-term (180 days) improvement of denture hygiene. □ *Denture plaque; gerodontology; oral hygiene; prosthetics*

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Poor denture hygiene seems to be a predisposing factor for fungus-induced stomatitis in denture wearers (1–4). Empirical data indicate that the denture cleanliness among elderly denture wearers is not very good (for a review, see Ref. 5).

Successful treatment and prevention of stomatitis has been obtained by removing plaque from the denture base mechanically (6) or chemically (7–9). However, most of the reported programs have been based on supervised or professional denture cleansing. Studies intending to induce behavioral changes in terms of increased plaque removal ability on the part of the denture wearers themselves seem not to have been reported.

Empirical evidence from communication research indicates that verbal information, regardless of its persuasive nature, rarely induces long-term behavioral changes, and thus the inclusion of skill training may be necessary to obtain a new behavior (for a review, see Ref. 10).

The purpose of the present investigation was to study the effect of information and demonstration programs on denture hygiene in a group of healthy old-age pensioners.

Materials and methods

The study group consisted of 150 edentulous pensioners 67–89 years old from a municipality near Oslo, who volunteered for the experiment. The participants had complete dentures in both jaws and were in good mental and physical health.

The subjects were stratified by sex, age, denture cleanliness, and denture shape and were then randomly assigned to two experimental groups and one control group. Twelve subjects did not complete the experiment and were not included in the analysis of the data. Of these, 11 belonged to the youngest age group and had a pre-experimental plaque score of 4–6 points (11). Table 1 shows the distribution of the other subjects by age and sex. It seems unlikely that the non-participants could invalidate the comparison of treatment effects.

The age of the dentures varied. Eighty per cent of them were more than 10 years old, and all of them exhibited some plaque on the fitting surface—that is, a score of 3 or more as measured by an additive index (11). The participants were interviewed with regard to regularity of use of the dentures,

Table 1. Distribution of the participants (p) and the non-participants (np) in the three study groups, in accordance with sex and age

Groups		Men		Women		Total
		67–74 years	75+ years	67–74 years	75+ years	
Verbal information (INFO)	p	8	5	18	14	45
	np	3		2		5
Verbal information + demonstration (DEMO)	p	11	4	20	14	49
	np		1			1
Control	p	9	5	14	16	44
	np	1		5		6
Total		32	15	59	44	150

denture problems, brushing routines, denture stomatitis, and oral hygiene. Thus 87% of the subjects answered that they had never received any information on how to clean their dentures. However, all of them maintained that they adhered to daily cleaning routines. Only one person was familiar with the diagnosis denture stomatitis.

The scoring method

Denture cleanliness was assessed in a double-blind manner by a morphometric point estimator scoring method (12), using color slides of the bases of the maxillary dentures after plaque discoloration (0.3% aqueous solution of proflavine hemisulfate). This method expresses the areas covered with plaque in percentage of the total denture base area (Fig. 1). One person (E.A.) performed all scoring independently of previous records.

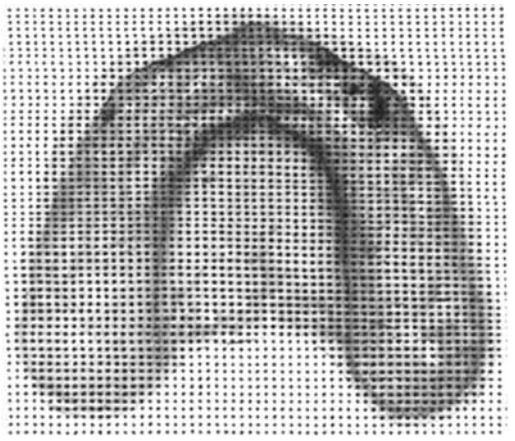

Fig. 1. The scoring method. The plaque score = $\frac{\text{No. of points in the plaque areas} \times 100}{\text{Total no. of points on the maxillary denture base}}$

The reproducibility of the scoring method was tested by duplicate scorings of 60 slides. The intra-examiner reliability coefficient was $r = 0.97$ (12).

Experimental design

At the start of the study, pre-experimental plaque scores were recorded before the experimental groups were given information or demonstration.

All participants were informed about the experiment by the dentist who also performed the scoring. The control group received no further information but was asked to continue their habitual cleaning procedures.

The subjects in the first experimental group (INFO) were given verbal information. It was explained that the presence of plaque on the denture base could have adverse effects and that denture stomatitis can be prevented by regular cleaning. It was pointed out that denture-induced stomatitis does not always give subjective symptoms such as soreness, painful mucosa, and foetor ex ore but should still be taken seriously because it may increase the risk of fungal

infections of the respiratory and alimentary tracts. Furthermore, it was pointed out that the retention of the maxillary denture could be affected. The participants were therefore advised to improve their brushing routines and were told how often they should brush and which remedies they should use. It took approximately 5 min to give the information.

In the second group (DEMO) the subjects were shown how to clean their maxillary dentures in addition to the verbal information. Plaque was disclosed, and the participants demonstrated how they removed the plaque from their dentures. To check denture cleanliness at home, the pensioners were given plaque-disclosing tablets (Displaque®) and were instructed how to use them. The mean time used per patient was approximately 25 min.

All information and demonstration were given individually between 0900 h and 1300 h. At the first visit the dentures in all three groups were professionally cleaned until no plaque could be seen.

Color slides of disclosed plaque on the denture base were taken after 14 and 180 days, and plaque accumulation was recorded by the same method as for pre-experimental scores. On day 14 the INFO group received the same information as at the start of the study. For the DEMO group demonstration of how to remove plaque was repeated in addition to the verbal information, and the present cleansing routines were corrected if necessary. The persons who had the highest plaque scores were stimulated to improve their routines or skills and were also requested to use the plaque-disclosing tablets.

Statistical analysis

Paired *t* test was used to test whether the plaque scores within the three groups increased over time. For statistical testing of the differences in mean plaque scores among the three groups the non-parametric Mann-Whitney test was used.

Subsequently, plaque coverage scores on days 14 and 180, respectively, were regressed to the level of the pre-experimental plaque scores in the three groups. This procedure is formally equivalent to an analysis of covariance and was used to determine whether the regression lines of the three groups were parallel (13, 14).

Results

Denture cleanliness showed no statistically significant inter-group differences at the start of the study as measured by the mean level of pre-experimental plaque scores (Table 2).

Table 2. Mean plaque coverage (in %) on the maxillary denture base, by study group and time of measurement

	Percentage plaque coverage		
	INFO ($n = 45$) $\bar{x} \pm SD$	DEMO ($n = 49$) $\bar{x} \pm SD$	Control ($n = 44$) $\bar{x} \pm SD$
Pre-experimental scores	46.0 ± 20.1	44.6 ± 19.5	37.9 ± 18.3
Base-line scores	0	0	0
Day 14 scores	26.5 ± 22.8	20.0 ± 19.7	33.0 ± 19.2
Day 180 scores	31.7 ± 21.5	22.4 ± 19.5	33.5 ± 20.9
Paired *t* tests within the groups			
Pre-experimental versus day 14	$p < 0.001$	$p < 0.001$	$p < 0.005$
Pre-experimental versus day 180	$p < 0.001$	$p < 0.001$	$p < 0.005$
Day 14 versus day 180	$p < 0.05$	$p < 0.05$	$p < 0.05$
Mann-Whitney test between the groups	Day 0	Day 14	Day 180
DEMO versus control	$p = 0.105$	$p = 0.0006$	$p = 0.005$
DEMO versus INFO	$p = 0.82$	$p = 0.08$	$p = 0.013$
INFO versus control	$p = 0.062$	$p = 0.04$	$p = 0.52$

Significant within-group differences in plaque scores were observed at 14 and 180 days both in terms of means (Table 2) and frequency distribution (Table 3). There was a tendency towards an increased number of persons with cleaner dentures and a reduced number of persons with high plaque scores in both experimental groups ($p < 0.05$; Table 3). The change was most pronounced in the DEMO group; in the control group only minor changes could be observed.

After 14 days the mean coverage of plaque on the denture base was 26.5% in the INFO group, 20.0% in the DEMO group, and 33.0% in the control group. These figures were significantly lower than the corresponding pre-experimental scores ($p < 0.05$; Table 2).

After 180 days the area of the dentures covered by plaque in the three groups had increased to 31.7%, 22.4%, and 33.5%, respectively, but was still significantly lower than before the start of the study (Table 2). The only statistically significant change from 14 to 180 days occurred in the INFO group, and after 180 days the INFO group had approximately the same mean level of plaque coverage as the control group. However, the plaque scores after 180 days did not reach the pre-experimental level in any of the groups (Table 2).

Differences in plaque scores between groups at day 14 showed that both the DEMO group and the INFO group had significantly lower mean plaque scores than the control group ($p < 0.05$; Table 2). The difference between the DEMO group and the INFO group was not statistically significant ($p > 0.05$, Table 2).

When the pre-experimental scores were introduced as a covariable, the plaque increment in the DEMO group differed significantly from that of the INFO and control groups as measured by the respective slopes (b = 0.53, 0.88, and 0.96) (Fig. 2). This means that there was interaction between pre-experimental plaque score and type of study groups on plaque increment. It can be seen in Fig. 2 that the plaque increment in the DEMO group was lower than that of the other groups at relatively high pre-experimental plaque scores.

On day 180 the plaque increment scores displayed essentially the same pattern as on day 14 (Fig. 3). The plaque scores were still lower in the DEMO group than in the other two groups (Table 2). When the pre-experimental scores were introduced as a covariable, the plaque increment in accordance with the pre-experimental score in the DEMO group differed significantly from that of the control group but not from that of the INFO group as measured by the respective slopes (b = 0.65, 0.86, and 1.05).

Table 3. Percentage distribution of subjects according to plaque score (%), study group and time of assessment

		Percentage plaque coverage					Chi-square test
	n	0–10%	11–30%	31–50%	≥50%	Total	
Pre-experimental scores							
INFO	45	0	29	31	40	100	4.33
DEMO	49	0	29	35	37	101	d.f. = 6
Control	44	2	43	29	25	99	$p > 0.05$
14 days							
INFO	45	24	51	9	16	100	16.4
DEMO	49	45	31	16	8	100	d.f. = 6
Control	44	11	45	25	18	99	$p < 0.025$
180 days							
INFO	45	16	44	22	18	100	15.7
DEMO	49	38	37	14	10	99	d.f. = 6
Control	44	16	27	34	23	100	$p < 0.025$

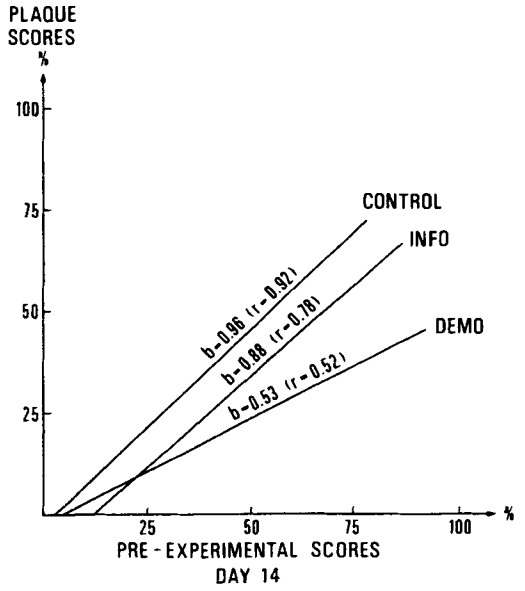

Fig. 2. Regression of denture plaque scores to pre-experimental scores on day 14 by groups.

Discussion

The present study showed that verbal information about denture hygiene to a group of old-age pensioners resulted in a short-term improvement of denture hygiene. However, to achieve any long-term improvement, demonstration of how to remove denture plaque seemed to be a prerequisite.

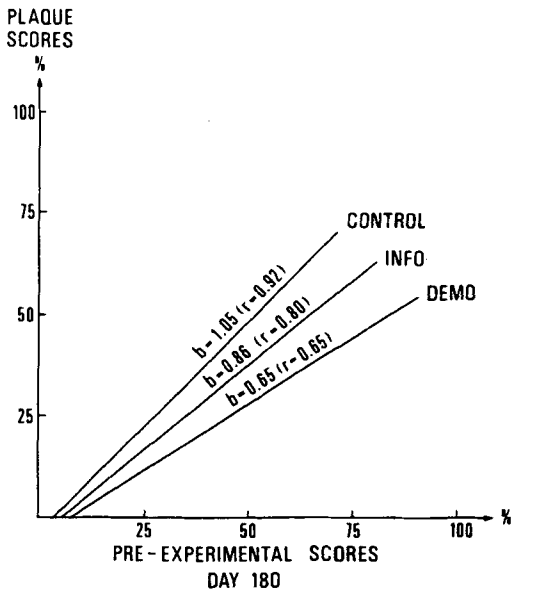

Fig. 3. Regression of denture plaque scores to pre-experimental scores on day 180 by groups.

These findings are consistent with the predictions in communication theories, which state that maintenance of a behavioral change requires that the new behavior is practiced and reinforced (10). Presumably, this has been achieved in the DEMO group by the skill training, and the use of plaque-disclosing tablets between the recording sessions may also have had an impact.

The observed effect of the programs is obviously confounded with the participation effect, as indicated by the reduction of plaque score in the control group (Table 2). However, it is likely that this effect is equally distributed in the three groups and may thus not invalidate comparison between the groups. Moreover, it is not possible to sort out the extent to which different times allotted to the experimental groups would distort the comparison of treatment effects.

In clinical trials of test agents or programs to reduce gingivitis or periodontitis, the initial extent of the disease merits special attention, because those who have the highest extent of disease will have the greatest potential for improvement (15). In particular, this is important if the within-group variation in the initial state is large, even if the groups have been balanced with regard to the initial state (15). In this study the pre-experimental level of the plaque score varied markedly within the three groups. Moreover, there was a tendency towards imbalance between the groups, because the control group tended to have lower pre-experimental plaque scores than the two other groups.

Analysis of covariance (13–15) was applied in the present study for two reasons: to adjust for bias in terms of between-group initial imbalance and to throw light on the nature of the treatment effects.

Empirically, it was shown that this analysis aided in the interpretation of the treatment effect. When interaction is present, it can be misleading to talk of an average treatment effect. Thus, the lower mean level of plaque

scores of the experimental groups to a great extent can be ascribed to a better denture hygiene among those who initially had the highest level of denture plaque. This means that the differences in final plaque score between those with high and low plaque scores initially had been leveled out, as measured by the lower correlation coefficients, particularly in the DEMO group. This may have some consequences for the future conduct of clinical trials that set out to test the denture plaque-reducing effect of agents or programs. The selective inclusion of denture wearers with high levels of denture plaque scores, to give the agents or programs every chance to demonstrate their effectiveness, might be indicated (16).

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