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Oral health of dental assistants and patients receiving maintenance – an investigation based on a district of Thuringia, Germany

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Ziebolz D, Klopfleisch S, Fresmann S, Hornecker E, Mausberg RF. Oral health of dental assistants and patients receiving maintenance – an investigation based on a district of Thuringia, Germany.

Abstract: *Objectives:* The aim of the study was to assess data for the oral health behaviour and oral health of dental assistants (DAs) and patients (PTs) who regularly received preventive dental care. *Methods:* One-hundred DAs (38.8 years) and 100 PTs (44 years) participated in the study conducted in the Unstrut-Hainich region of Thuringia, Germany. A questionnaire established oral hygiene and smoking habits. The dental examination included the caries index DMF-T, evaluation of the periodontal situation (PSI) as well as gingival inflammation [papilla bleeding index (PBI)]. *Results:* Seventy-seven DAs and 46 PTs used dental floss regularly. Twenty-four DAs and 27 PTs were smokers. The mean DMF-T of DAs was 12.5, which was significantly lower than the DMF-T of PTs (17.0) ($P < 0.001$). The main reason for this difference was the number of missing teeth (DAs: 0.9, PTs: 4.8; $P < 0.001$). In both groups, several participants required periodontal treatment. Nevertheless, the number of DAs with PSI scores 3 or 4 was significantly lower (9%) than the corresponding number of PTs (63%) ($P < 0.001$). The PBI showed a significant difference between the groups (DAs = 0.1, PTs = 0.3; $P < 0.01$). *Conclusions:* Although the oral health of the participating DAs clearly exceeded the results found for PTs, it was concluded that DAs did not avail themselves of their job-related knowledge and skills and so failed to optimize their personal oral health behaviour.

Key words: compliance; dental assistants; oral health; oral hygiene; patients; preventive dental care

Introduction

Caries and periodontal diseases are the most common human diseases. The majority of the population in Germany is affected (1). The results of the population-representative cross-sectional study DMS IV (Fourth German Study on Oral Health) showed a DMF-T of 14.5 in the age group of 35–44 years and 22.1 in the age group of 65–74 years as well as a high percentage of periodontal treatment need (PSI scores 3 and 4), 73.5% in age group of 35–44 years and 88% in age group of 65–74 years (1).

To avoid diseases like caries, gingivitis and periodontitis or to prevent their progression, preventive dental care has become increasingly important in recent years. Oral hygiene carried out at home, using fluoride dentifrice and/or fluoride cooking salt, has certainly contributed to the decline in caries (2, 3). These factors are complemented by improved dental care, increased awareness of oral health as well as patient-oriented individual prophylaxis interventional measures to support patients' compliance.

Comprehensive studies have revealed that if caries, gingivitis and periodontitis are diagnosed at an early stage, systematic prophylaxis – especially professional tooth cleaning at regular intervals – is necessary to avoid incidence or progression (4–6). Furthermore, they have shown a positive effect of professional prophylaxis on oral health (4–7), as well as individual and patient-focused recall intervals are essential for the long term success (8). In addition, different types of oral hygiene instruction showed a beneficial effect on adults' oral hygiene (9). Moreover, behavioural strategies seem to provide a significant improvement to oral hygiene measures at home and compliance (10). Therefore, an increasing number of dentists offer prophylaxis programs for adults.

Because of the specialist knowledge required, individual prophylaxis and professional tooth cleaning should be performed by a dentist or by trained dental professionals. Based on their particular education and experience, dental hygienists and dental assistants (DAs) have the knowledge and skills required. They are qualified to advise a patient individually and to perform professional tooth cleaning. It is therefore to be expected that both the attitude towards their own dental care and the maintenance of oral health are especially emphasized by these dental professionals. However, knowledge of comprehensive oral hygiene measures and the instruction of patients in oral hygiene do not appear to necessarily result in improved oral hygiene. Some studies that have investigated the oral health of dental professionals have raised doubts regarding their ability to effectively motivate patients (11–13).

We did not find any studies in the international literature that investigated the oral health of dental hygienists or DAs. The aim of this study was to assess data related to the oral health behaviour and oral health of DAs and patients [prophylaxis patients (PTs)] who regularly received preventive dental care.

The following hypotheses were formulated at the outset: (i) The oral hygiene behaviour of DAs is better than that of patients who regularly participate in a prophylaxis programme. (ii) The oral hygiene of DAs and PTs corresponds to the DMS IV representative for the population for an age group of 35–44 years.

Study population and methodology

We carried out a (non-randomized) clinical study to evaluate the oral health behaviour and oral health of DAs and patients (PTs) who had regularly received preventive dental care. The study was reviewed and approved by the ethics committee of the University Medical Center Goettingen, Germany (application No. 28/3/04).

Subjects

Dental assistants

In Germany, becoming a DAs requires a course of professional training. The 3-year course of education comprises on-the-job training and attending a professional school 1 day per week and is assessed by a final examination. In this study, DAs were defined as DAs who had completed such a training. Work experience extending over a minimum of 3 years following the final examination was a criterion for the inclusion of DAs in the study. The selection of DAs was by chance (not randomized). They were recruited by contacting 59 randomly selected dental practices in both municipal as well as rural districts in the Unstrut-Hainich region of Thuringia, Germany.

Prophylaxis patients

Prophylaxis patients were defined as patients who participated in dental prophylaxis programmes, that is, a minimum of one prophylaxis appointment each year. This included an oral hygiene control, oral hygiene instruction and professional tooth cleaning as well as fluoride application. The interval that had elapsed since the last prophylaxis had to be at least 3 months. All PTs were patients from one dental practice in the district town (Muehlhausen) of the Unstrut-Hainich region. Prophylaxis patients were selected by chance (non-randomized): there was no matching to the DAs.

Questionnaire

Prior to the clinical examination, all subjects filled out a questionnaire on oral hygiene behaviour, for example, brushing the teeth, interdental cleaning, fluoride application and smoking habits. In addition, the DAs were asked whether they make use of professional cleaning of the teeth.

Clinical examination

All subjects were examined once, under standardized conditions, by a calibrated dentist (κ value > 0.8). Prophylaxis patients were examined before the scheduled prophylaxis appointment, and the DAs were examined during an arranged appointment.

DMF-T and degree of caries restoration (14)

The DMF-T was assessed visually with a mirror and probe. All teeth showing a cavity in the dentine layer were assigned to the D (=decayed) category. Filled and crowned teeth were classified as belonging to the F (=filled) category. Wisdom teeth were not considered. The degree of restoration was calculated by the ratio of filled tooth surfaces to the carious plus filled surfaces $(F/(D + F) \times 100)$.

Periodontal findings

The periodontal situation (PSI) was evaluated with the periodontal screening index (PSI) (15, 16). The examination was performed with the WHO probe at 6 points per tooth (third molars were only included if they replaced the second molar), and the PSI score was recorded using following criteria:

- PSI 0: if pocket depth <3.5 mm, no bleeding and no calculus.
- PSI 1: if pocket depth <3.5 mm, bleeding on probing and no calculus.
- PSI 2: if pocket depth <3.5 mm, bleeding on probing and calculus is present.
- PSI 3: if pocket depth is 3.5–5.5 mm.
- PSI 4: if pocket depth is >5.5 mm.

The highest score was determined for each sextant of the dentition.

Gingival inflammation

The degree of gingival inflammation was assessed with the papilla bleeding index (PBI) (17, 18). The intensity of bleeding that occurred was assessed following streaking of the papilla (distal and mesial) with a periodontal probe (PCP 15; Hu-Friedy, Chicago, IL, USA). The intensity of bleeding was evaluated on a scale from 0 to 4: score 0 (no bleeding = no inflammation of the gingiva), score 4 (profuse bleeding = severe inflammation of the gingiva).

Statistical analysis

The statistical evaluation was carried out using the statistics software SPSS, version 12 (SPSS Inc., Chicago, IL, USA). The global level of significance was determined at $\alpha = 5\%$, according to the Bonferroni adjustment. The comparison between the groups for the calculation of significance was performed with the Mann–Whitney *U*-test (DMF-T, degree of caries restoration, PBI). The chi-square test was applied to the results of measurement with multiple distributions (index: PSI).

Results

Subjects

Table 1 shows the characteristics of both groups.

Dental assistants

One hundred and twenty-three DAs were contacted, of which 19% declined participating in the study without stating the reason. One-hundred DAs (mean: 38.8 ± 10.2 years) joined the study voluntarily. Fifty-five percent of them had been, at the time of the investigation, employed for more than 10 years as DAs (10–20 years: 30% and >20 years: 25%). Nineteen percent had been employed as DAs for 5–10 years and 26% for 3–5 years. Only 25% had undergone special (postgraduate) further training in dental prophylaxis. Twenty-four DAs were smokers, and 57 were non-smokers.

Prophylaxis patients

One hundred and eighty-three PTs were asked to participate in the study. One-hundred PTs (mean: 44.0 ± 9.1 years) joined the study voluntarily. Of these, 41% had regularly participated for 2–3 years in a prophylaxis programme, 42% for 3–5 years and 17% for more than 5 years. Seventy-one percent had been advised about the need for prophylaxis by the personnel at the practice and 28% by the dentist. Twenty-seven PTs were smokers, and 53 were non-smokers.

Table 1. **Participants' characteristics**

	DAs (n = 100)	PTs (n = 100)
Gender (female) (%)	100%	100%
Mean age ± SD (years)	38.8 ± 10.2	44.0 ± 9.1
Smoking habits (%)		
Non-smoker	57%	53%
Former smoker	19%	20%
Current smoker	24%	27%
Alcohol consumption (%)		
Never	25%	18%
Occasionally	70%	70%
Weekly	5%	12%
Medical problems (%)		
None (healthy)	67%	45%
Coronary heart disease	6%	30%
Diabetes mellitus	0	3%
Osteoporosis	1%	1%
Others	26%	21%

DAs, dental assistants; PTs, prophylaxis patients; SD, standard deviation.

Questionnaire

The results of the questionnaire are given in Table 2. Fifty-seven percent of the DAs and 71% of the PTs used an electric toothbrush, either exclusively or in combination with a manual toothbrush. Information about habits regarding cleaning of the inter-dental space varied: 77 DAs and 46 PTs used dental floss; 14 DAs and 21 PTs used interdental brushes. Twenty-seven DAs and 11 PTs applied a fluoride gel weekly.

Whilst 96 DAs indicated that a professional prophylaxis is essential and although most dental offices offered this service, only 63 DAs made use of this treatment themselves once or up to three times a year.

Clinical examination

Table 3 shows the results of the clinical examination.

DMF-T index and degree of caries restoration

The mean DMF-T of the DAs (12.5 ± 5.5) was significantly lower than the DMF-T of the PTs (17.0 ± 5.4) ($P < 0.001$). Table 3 shows the results of DMF-T, D-T, M-T and F-T. The number of missing teeth (M-T) led to differences between the two groups. The mean M-T of the DAs was 0.9, for the PTs 4.8. The difference was significant ($P < 0.001$). No significant difference was found regarding filled (F-T) and carious teeth (D-T) (Table 3).

Table 2. **Results of the questionnaire on oral health behaviour (%)**

	DAs (n = 100)	PTs (n = 100)
Importance of oral hygiene	100%	85%
Oral hygiene: brushing the teeth		
<1 × day^{-1}	0%	7%
1–2 × day^{-1}	75%	79%
3 × day^{-1}	25%	14%
Oral hygiene aids		
Toothbrush		
Manual	79%	42%
Electric	57%	71%
Inter-dental cleaning aids		
Dental floss	77%	46%
Interdental brush	14%	21%
Mouth rinse	31%	53%
Fluoride gel application weekly	27%	11%
Importance of regular professional tooth cleaning/dental prophylaxis	96%	85%
Participation in professional teeth cleaning/dental prophylaxis appointments	63%	100%
Regular dental prophylaxis		
Not regular	3%	–
1 × year^{-1}	18%	20%
2 × year^{-1}	34%	47%
3–4 × year^{-1}	8%	33%

DAs, dental assistants; PTs, prophylaxis patients.

The median degree of caries restoration of DAs and PTs was 100% with the DAs showing a slightly higher proportion of restored teeth. The difference between both groups was not statistically significant (P = 0.17). Two subjects amongst the DAs and none of the PTs had a healthy, caries-free dentition.

Periodontal findings

Seven percent of the DAs and none of the PTs had a PSI score 0. Twenty-one percent of the DAs and only 6% of the PTs were rated with a maximum PSI score 1. Sixty-three percent of the DAs and 31% of the PTs had calculus formations (maximum PSI score 2). Only for PSI score 3 and score 4, a significantly lower ratio of DAs (9%) was found than in the PTs (63%; $P < 0.001$) (Table 3).

Gingival inflammation

With a value of 0.1 ± 0.2, the mean PBI for the DAs was significantly lower than the data evaluated for the PTs with a value of 0.3 ± 0.3 ($P < 0.01$; Table 3). Thirty-nine percent of the DAs and 32% of the PTs were free of signs of gingival inflammation (PBI score 0).

Discussion

Summary of the main results

Most of the DAs and PTs reported that they perform interdental cleaning procedures at regular intervals. Whilst 96 DAs stated that professional prophylaxis is essential, only 63 DAs made use of this treatment themselves. The mean DMF-T of the DAs was significantly lower than that of the PTs. The main reason for this difference was the number of missing teeth. Several participants in both groups required periodontal treatment. Nevertheless, the number of DAs with a PSI score 3 or 4 was significantly lower than the corresponding number of PTs. The PTs showed more significant gingival inflammation than the DAs.

Comparison with the published literature

Based on their professional skills, DAs should possess extensive knowledge in the prevention and therapy of caries and periodontal disease. However, some evaluations have shown that theoretical knowledge does not necessarily result in implementation in practice, in this case, effective oral hygiene at home (11–13). In the present study, the oral health behaviour and the state of oral health of DAs and a patient

Table 3. **Clinical parameters of the two groups**

Clinical parameters	DAs (n = 100)	PTs (n = 100)	Significance level (P value)
DMF-T (mv ± SD, median)	12.5 ± 5.5 (12.5)	17.0 ± 5.4 (17.0)	<0.001
D-T (mv ± SD, median)	0.1 ± 0.3 (0)	0.3 ± 0.7 (0)	n.s.
M-T (mv ± SD, median)	0.9 ± 1.6 (0)	4.8 ± 5.2 (3.0)	<0.001
F-T (mv ± SD, median)	11.5 ± 4.8 (12.0)	11.8 ± 4.3 (12.0)	n.s.
Degree of caries restoration (median)	100%	100%	n.s.
PSI max. (%)			
Score 0	7%	0%	<0.001
Score 1	21%	6%	
Score 2	63%	31%	
Score 3	7%	40%	
Score 4	2%	23%	
Gingival inflammation: PBI (mv ± SD, median)	0.1 ± 0.2 (0.06)	0.3 ± 1.4 (0.2)	<0.01

DAs, dental assistants; DMF-T, number of carious, missing and filled teeth (caries index); D-T, carious teeth; F-T, filled teeth; M-T, missing teeth; mv, mean value; n.s., not significant = $P > 0.05$; PBI, papilla bleeding index; PSI, periodontal screening index; PTs, prophylaxis patients; SD, standard deviation.

group (PTs) regularly undergoing professional prophylaxis were examined. A questionnaire investigated oral hygiene behaviour and smoking habits. Caries and periodontal findings, as well as gingival inflammation, were used as parameters for assessing oral health.

The results of the questionnaire revealed that the oral hygiene behaviour of DAs in some fields was better than that of the PTs. At home, DAs as well as PTs maintained their oral hygiene with manual and/or electric toothbrushes and fluoride dentifrice: 71% of the PTs and 57% of the DAs used electric toothbrushes only or in combination with manual toothbrushes. In an Israeli study of Zadik *et al.* (19), only 8% of DAs and 7% of the control group (general population) used electric toothbrushes. The DAs in the present study demonstrated comparable willingness to carry out inter-dental cleaning (91%) than was found in the study of Zadik *et al.* (19). Similar investigations of DAs confirm the increased use of special implements for inter-dental cleaning (12, 13, 19–21). In the present study, more DAs than PTs reported regular use of a local fluoride application (fluoride gel). However, this was true for only one-third of the DAs. These results are in agreement with comparable surveys amongst DAs/students and patients receiving prophylaxis in Germany (13, 22).

Although DAs should be well aware of the risk of smoking with regard to periodontitis, the number of smokers was relatively high in this group (24%), as well in the PT group (27%). However, this percentage is comparable with the WHO data for 2000 (29%) (23), whereas the population-representative cross-sectional study DMS IV (Fourth German Study on Oral Health) found more smokers in the age group of 35–44 years (35%) in Germany (1). Nevertheless, in their study, Merchant *et al.* (20) found the percentage of non-smoking dentists to be 93.6% (former smokers: 54.4%), which is decidedly lower than the percentage of non-smoking DAs participating in our study. Twenty percent of the 200 subjects (19% DAs, 20% PTs) examined in the present study were former smokers (DMS IV: 21% former smokers). The main reason for quitting smoking was 'for health reasons', although this decision could have been influenced by the PTs' decision for professional prophylaxis. Other authors have also confirmed that if information is given at regular intervals during prophylaxis treatment, a reduction in or giving up of smoking can be achieved (24, 25).

Although 96% of the DAs consider professional prophylaxis to be an essential tool, only 63% made use of this treatment themselves regularly. This might be due to the fact that the need for treatment is (or should be) evaluated individually for each patient, and one-third of DAs were not aware of this need in relation to themselves and therefore show a lack of compliance in this aspect. The originally formulated hypothesis that the state of oral hygiene behaviour of DAs is better than that of PTs could be confirmed. Zadik *et al.* (19) concluded as well that DAs have better oral maintenance habits than others. Furthermore, in the Zadik study, the frequencies of dental examination in the DAs group (60–70% 1–2 per year) were higher than those in control/general population group (40–50% 1–2 per year) (19).

Caries prevalence

After all, subjects who have undergone further education often have better oral health (13). The results of the PTs in the present study are similar to the findings of Bastendorf (7) who evaluated the mean DMF-T of PTs at 15.8 (aged 35–44) or 18.4 (aged 45–54), respectively. Other studies on patients receiving prophylaxis showed significantly lower DMF-T than that found in the present study (5, 21, 22). Considering the components, the difference between DAs and PTs can be explained by the higher number of missing teeth (M-T) in the PT group. The study of Klinger *et al.* (13) on dental students (DMF-T = 10.8) and a control group of non-dental students (DMF-T = 14.0) revealed similar results. However, Maier did not find any differences in the DMF-T of DAs (DMF-T = 17.1) compared to a control group of non-dental professionals (DMF-T = 17.3) (21). In the present study, the variation in data may be due to the different mean age of the two groups (DAs: 38.8 years; PTs 44.0 years). Compared to the DMF-T for the population-representative cross-sectional DMS IV study in the age group of 35–44 (females: DMF-T = 15.1) (1), the DAs had better DMF-T values (12.5), whereas the mean DMF-T for the PTs (17.0) was higher (Table 4).

Periodontal situation

Comparing the periodontal findings of the population-representative cross-sectional DMS IV study in the age group of 35–44 (females), the PTs showed similar results, whereas the PSI of the DAs was clearly better (1) (Table 4). Klinger *et al.* (13) found similar findings for both DAs and subjects without professional dental knowledge. Although no subject was diagnosed as having a completely healthy PSI, more than 85% of the subjects showed no further need for periodontal treatment (score 1 = 46.3%; score 2 = 39.0%). In contrast to these findings, several of the PTs in the present study probably required further periodontal treatment (scores 3 and 4: 63%). Nevertheless, the different medical status of the two groups (diabetes mellitus: DAs = 0% and PTs = 3%; coronary heart disease: DAs = 6% and PTs = 30%) may have an impact on the PSI.

Gingival inflammation

With regard to the gingival inflammation (PBI) of the population-representative cross-sectional DMS IV study in the age group of 35–44 (females), both groups in the present study showed considerably better results (1) (Table 4). The investigation of Zimmer *et al.* (26) confirmed the efficiency of prophylaxis in relation to reduced gingival bleeding in DAs and patients. However, compared to the present study, the PBI values were slightly higher (26).

Table 4. **Dental findings, degree of caries restoration, periodontal findings and gingival inflammation in the present study and the Fourth German Study on Oral Health**

	Present study		DMS IV	
Oral findings	DAs 38.8 years (n = 100)	PTs 44.0 years (n = 100)	All subjects age group: 35–44 years (n = 925)	Female age group: 35–44 years (n = 454)
DMF-T (mv ± SD)	12.5 ± 5.5	17.0 ± 5.4	14.5 ± 5.7	15.1 ± 5.4
D-T (mv)	0.1	0.3	0.5	0.4
M-T (mv)	0.9	4.8	2.4	2.3
F-T (mv)	11.5	11.8	11.7	12.4
Degree of caries restoration (median)	100%	100%	96%	97%
PSI max. (%)				
Score 0	7%	0%	0.5%	0.5%
Score 1	21%	6%	12%	16%
Score 2	63%	31%	14%	16.5%
Score 3	7%	40%	53%	48%
Score 4	2%	23%	20.5%	19%
PBI (mv ± SD)	0.1 ± 0.2	0.3 ± 1.4	2.1 ± 1.2	2.0 ± 1.2

DAs, dental assistants; DMF-T, number of carious, missing and filled teeth (caries index), D-T, carious teeth; F-T, filled teeth; M-T, missing teeth; mv, mean value; PBI, papilla bleeding index; PSR®/PSI, periodontal screening index; PTs, prophylaxis patients; SD, standard deviation.

The originally formulated hypothesis that the state of oral health of DAs in this study corresponded to the DMS IV representative for the population for the age group of 35–44 years could not be confirmed: the DAs in the present study had a better oral health situation. However, the results for the PTs corresponded to the DMS IV results for the comparable age group. However, not in the case of PBI, these were better in the case of the PTs in the present study.

Limitation of the study

When interpreting the data from the present study, the fact should be taken into account that all PTs came from one practice, whereas the DAs worked in different dental practices. At the same time, it should be noted that the DAs could have different levels of knowledge about prophylaxis as a result of further training, as well as also as a result of a specific work environment. Despite regular participation in dental prophylaxis measures, the need for periodontal treatment on the part of PTs was unexpectedly high. Whether all PTs had undertaken parodontal treatment in advance and/or regular control examination of the PSI is unknown.

In addition, because the investigation was restricted to one region (Unstrut-Hainich region, Thuringia/Germany), the extent to which one can draw meaningful conclusions is limited by the fact that it is not representative for Germany as a whole. Therefore, a comparison with the population-representative cross-sectional DMS IV study in the age group of 35–44 was carried out. Social factors such as, for example, school education, marital status and general health consciousness could not be taken into account in the two groups.

Implication for dental practice

In the future, advanced training of DAs is essential. A combination of skills, knowledge and being a role model is the best tool for providing the necessary and sincere motivation of patients.

Conclusions

Overall, the dental professionals examined in this study showed better oral hygiene behaviour than the PTs studied for comparison. However, it is apparent that the DAs' professional skills and knowledge are far from being applied to their best in order to improve their individual oral hygiene.

Conflict of interest

The authors declare that they have no conflict of interests.

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