

Comparison of oral health among older people with and without dementia

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Older people with dementia are very dependent on nursing, and caregivers are frequently confronted with oral-care-resistant behaviour which may lead to shortcomings in oral health. **Objective:** To compare oral hygiene and health status of institutionalised older people suffering, or not, from dementia. **Basic research design:** Prospective cohort study (single-blind). **Clinical setting:** Institutionalised older population in south-west Germany. **Participants:** Ninety-three, allocated to two groups: dementia ($n=57$) and non-dementia ($n=36$) based on a mini mental state examination. **Main outcome measures:** Target variables were plaque control record (PCR), gingival bleeding index (GBI), community periodontal index of treatment needs (CPITN), and denture hygiene index (DHI). Differences between the dementia and non-dementia groups were evaluated by univariate testing of all target variables. **Results:** Univariate analysis revealed the amount of plaque in the dementia group was significantly higher than in the non-dementia group ($p=0.004$). Mean CPITN of participants in the dementia group was significantly worse than those of participants in the non-dementia group ($p<0.001$). All participants in the dementia group had periodontitis in at least one of the sextants, compared with 74% in the non-dementia group ($p<0.001$). For DHI ($p=0.198$) and GBI ($p=0.275$) no differences were found between the groups. **Conclusions:** Some aspects of oral hygiene and health seem to be worse for the institutionalised older people with dementia. Permanent specially adapted intervention for residents suffering from dementia in long-term care homes, and training for caregivers, is desirable to maintain life-long oral hygiene and health.

Key words: older people, dementia, oral health, hygiene

Introduction

Predicted demographic changes include an increase in the proportion of older people. In Germany, for example, 22.3 million of the population (29%) will be 65 years or older in 2060 (Statistisches Bundesamt, 2011a) and 743,000 older Germans (approximately 5% of residents aged 65 years and above) are currently living in long-term care homes (Statistisches Bundesamt, 2011b). As a consequence of successes in preventing dental problems in recent decades, many seniors have a large number of remaining teeth (Michaelis and Schiffner, 2006). This is a challenge to maintenance of healthy oral conditions for dependent older people, because of impairment of cognitive and motor function over time. Deterioration of oral hygiene among this institutionalised community has frequently been reported in the literature (Hoad-Reddick *et al.*, 1990; Montal *et al.*, 2006). Limited access to dental care services (Nischke *et al.*, 2001) and caregivers' lack of knowledge of the special oral hygiene needs of older people, among other factors, increase the likelihood of shortcomings in oral hygiene and, therefore, oral health (Adams, 1999). Reduced oral health can, for example, have direct functional effects on nutrition and speech, and general health may also be affected. It has been stated that oral diseases, for example periodontitis or other inflammatory diseases, are closely linked to the incidence of systemic diseases (Scannapieco, 1998) and an increased risk of cardiac infarction (Beck *et al.*, 1996) and ischemic stroke (Dörfer *et al.*, 2004) has been dem-

onstrated. It has, moreover, been confirmed that plaque on teeth or prostheses is capable of causing pneumonia (Scannapieco *et al.*, 1996). Despite these problems, little information about the oral health of older people suffering from dementia is yet available in the literature as acknowledged by a review article (Rejnefelt *et al.*, 2006). Alzheimer's disease (the most frequent type of dementia) is a common neurodegenerative disease of old age encompassing progressive symptoms, for example cognitive impairment and psychological and behavioural changes (Grossberg, 2003). Older people suffering from dementia are especially dependent on nursing help. Care givers are often confronted with affective disturbances and care-resistant behaviour, including difficulties in performing oral hygiene (Chalmers *et al.*, 1996; Mahoney *et al.*, 1999). It should also be mentioned that care givers must deal with many other tasks and, often, oral care does not, unfortunately, have priority. This can lead to poor oral health over time. Few studies have investigated the oral status of this compromised community. In general, oral health of older people with dementia was tested to be poorer than that of those without dementia (Rejnefelt *et al.*, 2006), with, specifically, greater incidence of coronal and root surface caries (Chalmers *et al.*, 2002; Ship, 1992; Ship and Puckett, 1994). Substantial Substantial decayed (D) and filled (F) increments in people with dementia were also confirmed by Ellefsen *et al.* (2009). Moreover, Syrjäälä *et al.* (2012) indicated a higher risk of poor oral hygiene and periodontal inflammation; similar results have been presented by Ribeiro *et al.* (2012). However,

others have reported contradictory findings. Comparable oral hygiene status, DMF scores and periodontal conditions were found among older people with and without dementia (Adam and Preston, 2006; Chen *et al.*, 2013; Hatipoglu *et al.*, 2011; Hopcraft *et al.*, 2012). It would be valuable to clarify the effects of dementia on oral hygiene, denture hygiene and oral health in a specific older long-term care community. The objective of this single-blind cohort study was, therefore, to compare the oral hygiene and health status of institutionalised older people suffering from dementia as measured by objective quantitative indices with those without dementia.

Method

This study was approved by local review board of the University of Heidelberg (approval number S-002/2012). All participants who met the inclusion criteria could participate in the study. For residents unable to give consent, the legal guardian was asked to decide whether or not his/her charge should participate in the study. Then he/she had also to sign the informed consent form. In this context, one should explain the German legal situation in terms of people not *sui juris*. A local court designates a legal guardian for those people. Frequently, this is a family member. In cases where family members cannot or do not want to care for their dependents, a professional legal guardian is authorised to handle all official affairs including medical decisions. Nevertheless, back in this recent study, the participant was additionally asked to consent prior to examination, even though the legal guardian already gave informed consent. The study was performed in four long-term care homes for older people all of one care society in south-west Germany as part of the EVI-P community-based cohort study. Participant inclusion criteria were only a signed consent form and permanent residence in a long-term care home. Some 113 participants, or their legal guardians, agreed to participation and were included in the study.

A mini-mental state examination (MMSE) of participants was performed by three psychologists. MMSE has been reported to be a valid instrument for detection of dementia (Folstein *et al.*, 1975). In this test the participant performs 30 brief exercises with different cognitive and motor dimensions including orientation, registration, attention, calculation, recall, and language. Each task was assessed as correct (1 point) or incorrect (0 points), so the score could range from 0 to 30. Scores equal to or below 20 were regarded as indicative of people with dementia, as recommended by Folstein *et al.* (1975). Group membership was allocated on the basis of MMSE outcome by a dentist (AZ) not involved in dental evaluation. Participants with scores from 0 to 20 were allocated to the dementia group; participants with scores greater than 20 were allocated to the non-dementia group (see Results). For each participant, age and gender (extracted from the care documentation) were recorded. The number of chronic diseases and frequently used drugs, according to medical reports, were also determined and recorded in case record forms. All dental examinations were performed by one dentist (TC) unaware of the MMSE results. Besides recording the target variables (see below) the number of missing or decayed teeth was assessed.

The main target variables were mean plaque (plaque control record; PCR, O'Leary *et al.*, 1972), gingival bleeding (gingival bleeding index, GBI; Ainamo and Bay, 1975), community periodontal index of treatment needs, CPITN (Ainamo *et al.*, 1982), and denture hygiene (denture hygiene index; DHI, Wefers, 1999). Determination of PCR entails counting of plaque-positive sites after disclosing (Mira-2-Ton; Hager & Werken, Duisburg, Germany). For application of this approach each tooth was divided into four sites (distal, buccal, mesial and lingual). PCR was calculated as the quotient of positive surfaces to 4 (i.e. to all recorded surfaces), and was reported as a percentage. To assess gingival bleeding, a periodontal WHO probe (CPC11.5; Hu Friedy, Tutlingen, Germany) was gently inserted and slid into the distal, buccal, mesial, and lingual gingival sulcus of a tooth followed by counting of bleeding sites (in relation to the number of all surfaces); again reported as a percentage. To assess the presence of periodontitis, CPITN examination was performed by use of a WHO probe. The CPITN includes 5 codes indicative of periodontal status. In the test, code 0 indicates a healthy condition, codes 1 and 2 are indicative of the presence of gingivitis, and codes 3 and 4 are indicative of moderate and severe periodontitis, respectively (Ainamo *et al.*, 1982). To determine denture hygiene, prostheses were rinsed with water, dried gently with gauze, and tinted with plaque indicator solution (Plaque Test; Ivoclar Vivadent, Schaan, Liechtenstein). Upper and lower prostheses were each divided into 10 areas. Sites where plaque was present were apparent as fluorescent areas on illumination with a dental polymerisation lamp (Bluephase III; Ivoclar Vivadent, Schaan, Liechtenstein). These sites were counted separately for each prosthesis and calculated as a percentage of total area. Completed case record forms were checked by two dentists of the Department of Prosthodontics (AJH and AZ). All data were independently entered twice. In the event of non-agreement of the two databases, case record forms were rechecked. Illegible records were interpreted by consensus. To assess differences between the target variables for the dementia and non-dementia groups, univariate analysis was performed for the dependent variables PCR, GBI, DHI, and CPITN. Gender and group membership were included in the models as factors with age as a covariable. Coagulation disorders and intake of anticoagulation inhibitors were included in the GBI model as a factor because of their conceivable effects on tendency to bleed. The level of statistical significance was set to $p < 0.05$. All statistical analysis was performed using SPSS v19.0 (IBM, USA).

Results

Twenty of the 113 participants withdrew their consent to undergo mini mental state examination during the study and were, therefore, excluded from further statistical evaluation. Complete target data were thus available for a study population of 93 participants (60, 65% female). Mean age of the participants was 82.9 years (sd 9.9, range 54 to 107). The mean number of chronic diseases per participant was 6.6 (sd 3.7), and the mean number of drugs taken frequently was 7.1 (sd 3.6). Mean number of missing and decayed teeth was 20.5 (sd 8.7) and 0.6

(sd 1.4), respectively. Of the study population, 40% were edentulous; 57 (61%) were in the dementia group and 36 in the non-dementia group. The mean PCR among the study population was 83.2% (sd 20.5). Mean GBI was 42.6% (sd 24.1), mean DHI was 85.1% (sd 15.7), and mean CPITN was 3.2 (sd 0.6). Complete results for the dementia and non-dementia groups are presented in Table 1.

Univariate analysis revealed PCR values were significantly lower in the non-dementia group than in the dementia group ($p=0.004$). Age ($p=0.533$, Table 2) and

gender ($p=0.943$) had no effect on PCR. Mean CPITN was significantly worse for the dementia group than for the non-dementia group ($p<0.001$, Table 3). All members of the dementia group had moderate to severe periodontitis in at least one sextant, compared with 74% in the non-dementia group ($p=0.001$). GBI was comparable among the groups ($p=0.275$, Table 4), but coagulation disorders and intake of coagulation inhibitors had a significant effect on GBI ($p=0.002$). DHI was not statistically significantly different between the two groups ($p=0.198$, Table 5), neither was age or gender.

Table 1. Mean target variables (and their standard deviations) in the dementia and non-dementia groups

	Dementia group		Non-dementia group		Total cohort	
Age, mean (sd)	83.1	(10.6)	82.6	(9.0)	82.9	(9.9)
Gender, frequency (%)						
Female	36	(38.7)	24	(25.8)	60	(64.5)
Male	21	(22.6)	12	(12.9)	33	(35.5)
Gingival bleeding (GBI), mean (sd)	43.8	(23.7)	40.9	(25.1)	42.6	(24.1)
Plaque Control Record (PCR), mean (sd)	90.1	(13.1)	73.3	(25.1)	83.2	(20.5)
Denture hygiene (DHI), mean (sd)	87.5	(16.0)	81.5	(14.8)	85.1	(15.7)
Community periodontal index of treatmentneeds (CPITN), mean (sd)	3.4	(0.5)	2.8	(0.6)	3.2	(0.6)
Prevalence of periodontitis, frequency (%)	33	(100.0)	18	(73.9)	51	(89.5)
Missing teeth, mean (sd)	20.8	(8.5)	19.9	(9.1)	20.5	(8.7)
Decayed teeth, mean (sd)	0.6	(1.3)	0.7	(1.4)	0.6	(1.4)

Table 2. Univariate analysis with mean Plaque Control Record (PCR) as the dependent variable ($n=56$)

Effect	Regression	95%CI	p
Constant term	86.8	43.3, 130.3	<0.001
Gender			
Female	0.4	-10.8, 11.7	0.943
Male	0	-	-
Age	-0.2	-0.7, 0.4	0.533
MMSE			
Dementia group	16.3	5.5, 27.1	0.004
Non-dementia group	0	-	-

Table 3. Univariate analysis with the Community Periodontal Index of Treatment Needs (CPITN) as the dependent variable ($n=56$)

Effect	Regression	95%CI	p
Constant term	2.8	1.6, 4.0	<0.001
Gender			
Female	-0.2	-0.5, 0.2	0.311
Male	0	-	-
Age	0.0	0.0, 0.0	0.909
MMSE			
Dementia group	0.6	0.3, 0.9	<0.001
Non-dementia group	0	-	-

Table 4. Univariate analysis with the Gingival Bleeding Index (GBI) as the dependent variable ($n=56$)

Effect	Regression	95%CI	p
Constant term	12.8	-40.7, 66.3	0.633
Gender			
Female	2.9	-10.4, 16.2	0.662
Male	0	-	-
Age	0.2	-0.5, 0.8	0.629
MMSE			
Dementia group	7.0	-5.8, 19.8	0.275
Non-dementia group	0	-	-
Coagulation inhibitors			
Yes	20.5	7.7, 33.3	0.002
No	0	-	-

Table 5. Univariate analysis with the denture hygiene index (DHI) as the dependent variable ($n=67$)

Effect	Regression	95%CI	p
Constant term	84.6	42.0, 127.2	<0.001
Gender			
Female	-5.3	-13.8, 3.3	0.224
Male	0	-	-
Age	0	-0.5, 0.5	0.972
MMSE			
Dementia group	5.2	-2.8, 13.1	0.198
Non-dementia group	0	-	-

Discussion

The results of this study suggest that some aspects of oral hygiene and health are worse in dependent older people suffering from dementia than in those without dementia. This is in agreement with other studies, although in this regard mainly plaque, caries, and saliva were evaluated (Chalmers *et al.*, 2002; Ship, 1992; Ship and Puckett, 1994). Because PCR values were lower for individuals without dementia, one might question the causes. One explanation could be that dementia patients must perform oral hygiene themselves and support from care givers might be hindered because of resistance to care (Chalmers *et al.*, 1996; Mahoney *et al.*, 1999). Determination of PCR value only provides information about current oral hygiene status, however, this effect was comparable in both groups. Use of the community periodontal index of treatment needs detected greater prevalence of periodontitis in older people with dementia indicating poorer oral health among this compromised group which may be a consequence of plaque accumulation over a long time. Denture hygiene index was not different between the two groups as also found by Ribeiro *et al.* (2012). One explanation might be that it is easier for the care givers to perform adequate prosthesis hygiene than oral hygiene because the former is not hindered by uncooperative patient behaviour. Another reason could be that compromised residents no longer wear their dentures and dentures remain always clean, but unworn, in a cleansing agent. This variable was not assessed. With regard to gingival bleeding, no differences were found between the dementia and non-dementia groups but intake of coagulation inhibitors had a distinct effect. In general, the results of this study include an important limitation with regard to sample size - it would have been desirable to achieve a greater response though all consented potential residents of the four homes of one care society were included in this study. Another topic which should be discussed is the ratio of dementia to non-dementia participants. Of the study population tested 61% suffered from dementia: a proportion near the middle of the range reported for residents in German long-term care homes, 50 to 69% (Berlin-Institut für Bevölkerung und Entwicklung, 2011).

Considering the clinical relevance of these findings, since older people suffering from dementia are primarily dependent on nursing, one starting point should be raising caregivers' awareness of the oral shortcomings in residents suffering from dementia. Suitable dental education programs should be offered which might encompass specific trainings in mouth care for older people as well as teaching of strategies that reduce or avoid care-resistant behaviour. One strength of this study which should be mentioned is that only one experienced dentist performed all the examinations and he was unaware of group membership (single-blind study). Nevertheless, the blinding is qualified by the fact that the examiner certainly may have recognised symptoms of dementia in some cases. In this context, it should be also borne in mind that participants were not pre-selected.

Conclusions

Within the limitations of this study, oral hygiene (plaque) and oral health, as manifested by the prevalence of periodontitis, are worse among institutionalised older people with dementia. Longitudinal studies of the effect of oral hygiene intervention for this specific community, for example training of care givers, would be desirable. Suitable intervention should be permanently established in long-term care homes to preserve adequate life-long oral hygiene and health.

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