

## Research Article

# Oral Health of Older Individuals in Long-Term Care: An Evaluation of Residents in Private Homes and Nursing Homes

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## Abstract

**Introduction:** The demographic change results in an increasing number of older adults in long-term care. Long-term care can be provided either non-institutionalized by nurses/relatives at private home or institutionalized in nursing homes. As oral health is associated with general health and overall quality of life, numerous studies addressed the oral health of older people in nursing homes. Clinical investigations focusing on older high-maintenance people living at their private home are still limited. Therefore, the purpose of this investigation was the evaluation and comparison of the oral health of older individuals in long-term care living at home and in nursing homes.

**Methods:** Data were collected from 121 home residents and 243 nursing home residents. A questionnaire was used for self-reported data. Within the intraoral examination, Decayed/Missed/Filled Teeth (DMFT), the condition of the oral mucosa and oral hygiene and removable dental prostheses were recorded.

**Results:** Nursing home residents were older (85.4±9.01 years) than home residents (82.7±9.87 years). Most participants had not used dental services for several years and the DMFT value was higher the longer the utilization was delayed. The older removable dental prostheses were, the higher the DMFT value was. The condition of oral hygiene and mucosa was better with higher DMFT values. Overall, 77.6% of the home residents and 80.9% of the nursing home residents, respectively, felt satisfied with their personal oral situation.

**Keywords:** Oral health; Older people; Nursing homes; Long-term care

## Abbreviations

DMFT: Decayed/Missed/Filled Teeth; RDP: Removal Dental Prosthesis/Prostheses

## Introduction

The demographic change is sufficiently known and the statistics show that our population is continuously aging [1]. Consequently, the percentage of older adults is growing in most societies, and population aging occurs as a global phenomenon [2]. In 2015, 8.2% of the world's population was ≥65 years old. In the European Union in 2018 lived 101.1 million people at the age of ≥65 years. According to statistical forecasts, this number will increase by 48.1 million within the next thirty years [2].

Inevitably, not only the number of older people, but also the number of older people in long-term care, will increase. Depending on individual capacity, care can be provided non-institutionalized by care providers, e.g. home care services and relatives, at private homes, or institutionalized in nursing homes.

The beginning of care-dependency and long-term care is significantly related to a reduced use of dental services [3]. This is particularly problematic because dental prevention and therapy in old age is necessary, also in terms of general health, as multiple systematic diseases are associated with oral health [4-7]. Insufficient

oral hygiene is related to respiratory diseases and pneumonia, which can be lethal [8,9]. Periodontal diseases show an interaction with diabetes mellitus and increase the risk of cardiovascular diseases, as a result of the systemic burden of oral microorganisms [4,6,7,10,11]. Insufficient oral situations, like reduced masticatory function or poorly fitting removable dental prostheses, can support malnutrition [12,13]. Furthermore, oral health-related factors are associated with the overall quality of life [14,15].

Since the proportion of older individuals in society is growing, numerous investigations were conducted focusing on older people in need of care [3,15-35]. In summary, oral-health situations are frequently not satisfactory; inadequate oral hygiene, caries, inflammatory disease of the gingiva/periodontium, and dental prostheses-related problems are reported [3,15-33]. Although older adults are a heterogeneous group with variety of cognitive and functional impairments, which makes comparing clinical trials more difficult, multiple factors associated with poor oral health have been identified [36]. Numerous investigations on the oral situation of older people are available, but there are limited surveys, which include older individuals in long-term care living at private homes, analyzing the impact of the place of residence. Kelly et al. hypothesized that preventive oral health care utilization would decrease when older people move into an institutional setting [18]. De Visschere et al., analyzed the data of home living older people and nursing home

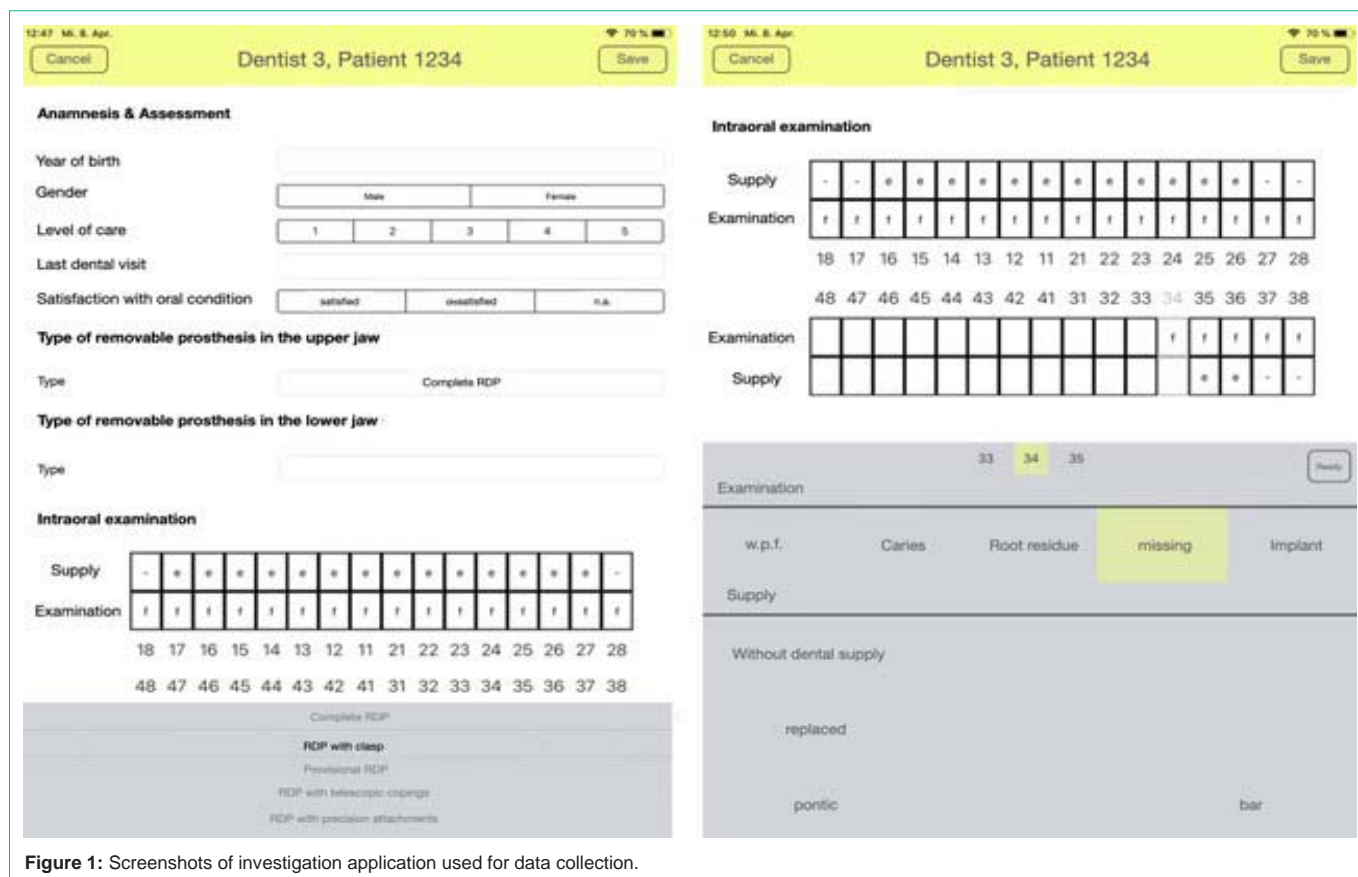


Figure 1: Screenshots of investigation application used for data collection.

residents in Belgium [21]. As far as the authors are aware, no systematic clinical investigation has been published focusing on the evaluation of dental situations of older people living at private home or nursing homes, especially in Germany.

Therefore, the aim of the present investigation was the description and evaluation of the oral health of older people in need of care who lived at their private homes supported by home care services/relatives and those who were institutionalized in nursing homes. The aspects of interest were the dental and restorative status, condition of the mucosa, dental hygiene, and removable dental prostheses. In addition, self-estimated data regarding oral health were recorded. The following hypothesis was stated: there is no significant difference in objective and subjective oral health-related variables depending on the place of residence.

## Methods

This prospective investigation was conducted in accordance with the Declaration of Helsinki. The investigation protocol was approved by the ethics committee (project no. 245-16). Written informed consent was obtained from all participants or their legal representative before enrolment.

## Participants

Older adults in long-term care living either non-institutionalised at their private home supported by care provider (home care services/relatives) or institutionalised in nursing homes were invited to participate in the present investigation. The nursing homes were

general long-term facilities including each level of care. Inclusion criteria were:

- (1) Born before 1964,
- (2) Care-dependency,
- (3) The ability to answer questions, which were ask verbally, and
- (4) The ability to go through a short intraoral examination.

To generate a wide spectrum of participants, no preselection was applied and no additional exclusion criteria were stated.

## Data collection

A total number of 364 individuals participated in the present clinical investigation. Four dentists and their dental nurses visited the participants at their place of residence, whether at private home or at the nursing home. The teams were equipped with tablet computers (iPad mini, Apple Inc., Cupertino, United States) and - if desired - with portable dental units. On tablet computers, an application was installed, which was written and programmed specially for the present investigation. The application allowed the digitisation of data during the participant's visit, because all findings were entered into the application immediately (Figure 1). To ensure anonymised data handling at the earliest possible date, identification numbers were used instead of personal information. The identification numbers were assigned exclusively by the respective dentists and not disclosed.

All dentists and their dental assistances were trained and calibrated at the Department before data collection, and additionally

three months later. Therefore, examination variables were explained and ratings were discussed using anonymised images and data.

A brief questionnaire was developed in consultation with seven experienced dentists, who were specialised in prosthodontics and gerontology. Four questions addressed the dental situation of the participants with two additional questions focused on removable dental prostheses (Table 1).

For intraoral examination, a dental mirror, dental forceps, dental probe, and pellets were used. For illumination, a headlight was available. The following variables were recorded:

- (1) Decayed or missed or filled teeth (according to DMFT Index) (excluding third molars)
- (2) Condition of the oral mucosa (good/medium/poor)
- (3) Condition of the oral hygiene (good/medium/poor)
- (4) Type of removable dental prosthesis (RDP) in the upper and/or lower jaw (complete RDP/RDP with telescopic copings/RDP with precision attachments/RDP with clasps/implant-supported RDP/provisional RDP/no RDP)

For caries diagnostics, the World Health Organisation (WHO) 'Oral health surveys: basic methods - 5<sup>th</sup> edition' guideline was applied [37]. No x-rays were performed. The grade of the oral mucosa was based on gingivitis classification. The initial phase of gingivitis was rated as 'good', the early phase as 'medium', and the late phase was stated as 'poor' condition. The rating of the oral hygiene was associated with smooth and hard debris. An intraoral situation was rated as 'good' when no smooth and/or hard debris was found. It was rated as 'medium' in cases where smooth and/or hard debris was detected and 'poor' in cases of generally smooth and/or hard debris.

**Statistical analyses**

Statistical analysis was performed using SPSS version 25.0 (IBM, Armonk, NY, USA). For description purposes, frequencies and means (Standard Deviation [SD]) were plotted. To compare the characteristics of the groups, Wilcoxon rank sum test with continuity correlation was applied. For nonparametric statistics, Spearman correlation was used to analyse correlations between DMFT value, place of residence and variables. Respectively, Pearson correlation was used for metric values. The level of local statistical significance was set at P<0.05.

**Table 1:** Questionnaire used to interview the residents.

Question	Answer possibility
How old are you? (in years)	
How long has it been since you last used dental service? (in years)	
Who takes care of the teeth and removable dental prostheses?	Resident/resident+ caregiver/ caregiver/nobody
Can you eat everything?	yes no
Are you satisfied with your oral situation?	yes no
In case of having removable dental prostheses: How old is your upper and/or lower dental prosthesis? (in years)	
How often do you wear your upper and/or lower dental prosthesis?	Always occasional never

**Results**

**Age and gender**

The participant characteristics are shown in Table 2.

The mean age of the participants was significantly (p=0.027) different between nursing home residents and home residents, whereas home residents were older (85.4±9.01 years) than nursing home residents (82.7±9.87 years). Additionally, women were significantly older than men were in both groups (home residents: p=0.026, nursing home residents: p<0.001). Female home residents presented an age of 86.8±7.88 years and female nursing home residents were 84.6±9.36 years old.

**Evaluation of the questionnaire**

**Utilisation of dental services:** Dental services were not used for different periods in both groups (p≤0.001). Home residents had no utilisation for a period of 3.78±3.52 (1-18) years, while nursing home residents had not used dental services for 7.60±4.32 (0-17) years.

**Responsibility for dental hygiene and removable dental prostheses:** Most frequently, home residents and nursing home residents had sole responsibility for dental hygiene and removable dental prostheses: 52.9% and 49.4%, respectively. In 18.5% (home residents) and 14.9% (nursing home residents), the sole responsibility was assigned to a caregiver - a relative or nurse. Caregivers and participants shared responsibility in 21.0% (home residents) and 15.9% (nursing home residents). In 7.56% (home residents) and 20.8% (nursing home residents), nobody was responsible for oral hygiene and care of dental prostheses (p=0.008).

**Restriction regarding food intake:** Regarding the limitations of food intake, 59.3% of home residents and 53.3% of nursing home residents indicated that they were able to eat without any restrictions.

**Satisfaction with oral situation:** Overall, 77.6% of home residents and 80.9% of nursing home residents felt satisfied with their

**Table 2:** Participants' characteristics.

	Home residents	Nursing home residents
N	121	243
Sex		
Female (n%)	85/70.0	172/70.8
Male (n%)	36/30.0	071/29.2
Age in years		
(Mean±SD (Min-Max))	85.4±9.01 (60-104) <sup>a</sup>	82.7±9.87 (51-103) <sup>a</sup>
Age women in years		
(Mean±SD (Min-Max))	86.8±7.88 (62-104) <sup>a</sup>	84.6±9.36 (50-103) <sup>a</sup>
Age man in years		
(Mean±SD (Min-Max))	82.0±10.6 (60-100) <sup>a</sup>	78.3±9.73 (48-95) <sup>a</sup>
Year of birth (n%)		
Before 1916	003/2.48	002/0.82
1916-1941	105/86.8	190/78.2
1942-1951	009/7.44	035/14.4
1952-1964	004/3.31	014/5.76
After 1964	000/0.00	002/0.82

<sup>a</sup>P<0.05; Wilcoxon rank sum test.

**Table 3:** Findings and answers regarding removable dental prosthesis.

	Home residents		Nursing home residents	
	Upper jaw	Lower jaw	Upper jaw	Lower jaw
Type (n/%)				
Complete	65/53.7	33/27.3	105/43.2	055/22.6
+ telescopic copings	07/5.79	17/14.1	010/4.12	014/5.76
+ precision attachments	03/2.48	04/3.31	001/0.41	001/0.41
+ clasps	07/5.79	12/9.92	015/6.17	021/8.64
Implant-supported	00/0.00	03/2.48	003/1.23	008/3.29
Provisional	03/2.48	01/0.83	002/0.82	003/1.23
No	36/29.8	51/42.2	107/44.0	141/58.0
Age of RDP <sup>a</sup> in years	11.5±6.60	11.1±6.55	15.0±7.49	15.3±7.48
(Mean±SD (Min-Max))	(0-30) <sup>b</sup>	(0-51) <sup>b</sup>	(1-30) <sup>b</sup>	(1-30) <sup>b</sup>
Frequency of wearing (n/%)				
Always	76/91.6	63/90.0	123/90.4	89/87.3
Sometimes	07/8.43	06/8.57	004/2.94	02/1.96
Never	02/2.41	01/1.43	009/6.61	11/10.8

<sup>a</sup>Removable dental prosthesis  
<sup>b</sup>P<0.05; Wilcoxon rank sum test.

oral situation, respectively.

**Removable dental prostheses:** Detailed findings are listed in Table 3. Different types of removable dental prostheses were used. The age of removable dental prostheses varied. In comparison, maxillary dental prostheses of nursing home residents were significantly (p<0.001) older (15.0±7.49 years) than upper dental prostheses of home residents (11.5±6.61 years). Equivalent values were found for removable dental prostheses in the lower jaw (p<0.001). Mandibular dental prostheses of home residents were 11.1±6.55 years old, while mandibular dental prostheses of nursing home residents were 15.3±7.48 years old. The frequency of wear was similar in both groups.

**Outcomes of intraoral examination:** Detailed outcomes of the intraoral examination (DMFT Index, complete dental prosthesis, and the condition of the mucosa and the oral hygiene) are presented in Table 4. Overall, 68.3% of nursing home residents and 58.0% of home residents (edentulous excluded) had at least one decayed tooth. In nursing home residents, 512 of 1882 remaining teeth (27.2%) were decayed and 153 of 1176 remaining teeth (13.0%) in home residents were affected by caries. Participant’s oral hygiene was evaluated as ‘good’ in 27.3% of home residents and 38.7% of nursing home residents. The oral hygiene was ‘medium’ in 40.5% of home residents and 35.0% of nursing home residents, while 32.2% of home residents and 26.3% of nursing home residents had oral hygiene that was evaluated as ‘poor’ (p=0.047).

**Correlation between variables, place of residence, and DMFT value:** No significant correlation between participants’ age (Table 4), gender (Table 4), responsibility for dental hygiene/removable dental prostheses, restriction regarding food intake (Table 5), satisfaction with oral situation (Table 5), frequency of wearing removable dental prostheses, place of residence (private home/nursing home) and DMFT value was found. Statistically significant correlations were analysed for the following variables:

**Utilisation of dental services:** The DMFT value within nursing

**Table 4:** Outcomes of intraoral examinations.

	Home residents	Nursing home residents
DMFT <sup>a</sup> all		
(Mean±SD (Min-Max))	25.6±5.23 (5-28)	24.6±5.70 (3-28)
DMFT <sup>a</sup> gender		
(Mean±SD (Min-Max))		
Female	25.0±4.68 (8-28)	24.8±5.15 (8-28)
Male	23.8±6.34 (5-28)	23.7±6.82 (3-28)
DMFT <sup>a</sup> year of birth		
(Mean±SD (Min-Max))		
Before 1916	26.7±2.31 (24-28)	28.0±0.00 (0-00)
1916-1941	24.6±4.88 (8-28)	25.2±4.95 (7-28)
1942-1951	24.7±6.73 (9-28)	23.8±6.06 (5-28)
1952-1964	22.3±11.5 (5-28)	18.0±8.27 (3-28)
After 1964	-	-
Edentulous (n/%)	40/33.1	79/32.5
with two RDP <sup>b</sup>	30/75.0	49/62.0
with upper RDP <sup>b</sup>	06/15.0	11/13.9
without RDP <sup>b</sup>	04/10.0	19/24.1
Condition of oral mucosa (n/%)		
Good	37/30.6	100/41.2
Medium	58/47.9	086/35.4
Poor	26/21.5	057/23.5
Edentulous and (n/%)		
Good mucosa	16/43.2	53/53.0
Poor mucosa	03/11.5	06/10.5
Condition of oral hygiene (n/%)		
Good	33/27.3 <sup>c</sup>	94/38.7 <sup>c</sup>
Medium	49/40.5 <sup>c</sup>	85/35.0 <sup>c</sup>
Poor	39/32.2 <sup>c</sup>	64/26.3 <sup>c</sup>
Edentulous and (n/%)		
Good oral hygiene	14/42.4	49/52.1
Poor oral hygiene	09/23.1	08/12.5

<sup>a</sup>Decayed, Missed, or Filled Teeth,  
<sup>b</sup>Removal dental prosthesis/prostheses,  
<sup>c</sup>P<0.05; Wilcoxon rank sum test.

home residents was higher the longer it had been since the last use of dental services (p<0.001, Pearson’s correlation coefficient: 0.26).

**Age of removable dental prostheses:** The older the removable dental prostheses were, the higher the DMFT value in both groups (nursing home residents, lower jaw dental prostheses: p=0.005, Pearson’s correlation coefficient: 0.274).

**Condition of the oral mucosa:** Significant correlations were calculated for the variables condition of the oral mucosa, DMFT value, and place of care (home residents: p=0.006, Spearman’s rank correlation coefficient: -0.250; nursing home residents: p=0.012; Spearman’s rank correlation coefficient: -0.162). The condition of the mucosa was better with higher DMFT values, in both groups.

**Condition of the oral hygiene:** For the variable condition of



**Table 5:** DMFT<sup>a</sup> values (Mean±SD) and standard deviation in correlation to variables (brackets contain minimum and maximum values).

	Home residents	Nursing home residents
Restricted food intake		
Yes	26.1±3.61 (15-28)	25.5±4.77 (7-28)
No	23.5±5.95 (5-28)	23.6±6.29 (3-28)
Satisfied oral situation		
Yes	24.2±5.11 (8-28)	24.3±5.86 (5-28)
No	25.6±5.64 (5-28)	25.2±5.06 (3-28)

<sup>a</sup>Decayed, missed, or filled teeth.

the oral hygiene, a significant correlation (nursing home residents:  $p=0.003$ , Spearman's rank correlation coefficient:  $-0.192$ ) was determined. In both groups, the condition of the oral hygiene was better when the DMFT value was higher.

## Discussion

The findings of the present investigation demonstrate the insufficient oral situation of older people in long-term care. In particular, the description of residents' situation living at home is interesting, because the acquisition and examination of this multi-morbid population for trials is challenging. This may also be the reason why limited investigations are available [18,21].

The stated hypothesis, that there are no statistically significant differences in objective and subjective oral health-related variables depending on the place of residence, was rejected. The reasons are discussed in the following.

Within this investigation, age and gender distribution of nursing home residents were equal to other study cohorts and - as expected - the share and age of women were higher [19,21,22]. Home residents were significantly older. This suggests that older adults who do not require a high level of care prefer to stay in their private homes, regardless of their age.

Most participants had not used dental services for several years. Niesten et al. reported that 53% of older people stated that their dental service use frequency had reduced since the onset of their dependence [3]. Multiple factors may lead to less frequent utilisation [23,24]. In general, impaired mobility or immobility and a decreasing general state of health can handicap transportation to a dental practice and dental treatment [24-26]. Additionally, the frequency can be influenced by the personal responsible for oral care. For older individuals, who bear the sole responsibility for their dental hygiene and removable dental prostheses, oral hygiene may deteriorate as manual dexterity and cognitive function decline [3,16,17,20,27,28]. This increases the requirement for dental treatment, but a lack of self-perceived need and a decreasing general state can lead to neglected oral health and a reduced dental services use [3,20,24,27,28]. These aspects could explain the long periods to latest dental services use in the present clinical investigation, because one out of two residents had the sole responsibility for oral and removable dental prostheses' care, in both groups. On the other hand, fiving sole responsibility to a caregiver may also lead to reduced oral hygiene and use of dental services. Caregivers have numerous tasks to perform to meet the specific physical and mental needs of older people in need of care, so appropriate oral hygiene can be challenging [29,30,38]. In addition,

oral health decreases in priority when the individuals general health deteriorates [19,31,38]. Furthermore, an edentulous older individual without removable dental prostheses (home residents: 3.01%, nursing home residents: 7.82%) may be suggestive of not having any demand on dental services. A self-care frailty and the refusal of assisted oral care can lead to a situation in which nobody takes care of the teeth and removable dental prostheses [3,20,27,28]. In the present investigation, nobody was in charge of oral hygiene in 20.8% of nursing home residents (7.56% of home residents). In those cases, the need for dental treatment cannot be identified and preventive measures cannot be applied. This finding is in line with long periods to the last dental services use of nursing home residents in this investigation. Another influencing factor is personal satisfaction with the individual oral situation, which may result in symptom-driven and less frequent utilisation. In the present investigation, almost eight out of ten participants were satisfied with their oral situation whether they lived at their private home or in a nursing home. On one hand, this finding is contrary to the objective oral situation of older people. On the other hand, it is in line with the evidence that frail older people evaluate their own state of health better [39]. Therefore, a discrepancy occurs between objectively measured and self-perceived oral health [32,40]. It is also known that general satisfaction is transferred to the dental situation, regardless of the objective conditions [14].

In this investigation, removable dental prostheses in the lower jaw of nursing home residents were significantly older than those of home residents were. Overall, removable dental prostheses presented a higher age in both groups. This finding is congruent, because participants' last dental services use was delayed for years, especially of nursing home residents. In 2013, Niesten et al. conducted a qualitative study using in-depth questionnaires within open interviews. Although the study cohort was smaller ( $n=51$ ) than other trials, and bias occurred, the investigation identified several factors with an influence on oral care behaviour in detail. Results showed that the majority of frailest institutionalised participants felt no need for dental services use because of a disproportionate effort with no prospects for improvement, although a high number of subjects were unsatisfied with their removable dental prostheses [26]. In addition, participants believed that relief was more easily obtained by abstention of the mandibular removal denture prosthesis than by consulting a dentist [26]. This finding is in line with the high number of nursing home residents who did not wear their mandibular prostheses (nursing home residents: 10.8%), in this investigation. Additionally, Nitschke et al. found that wearing removable dental prostheses (9.8%) and a lack of a subjective need for treatment (86.5%) were reasons for the non-utilisation of dental services [24]. Furthermore, removable dental prostheses may preferably be repaired or adjusted than renewed, because extended dental treatments can be arduous for patients in their old age [25].

In the present investigation, nursing home residents tended to have a better oral hygiene than home residents did. However, a high number of edentulous unsupplied jaws in this group might have an influence on this finding. An edentulous jaw tends to be easier to clean for an older manual restricted individual or a caregiver than teeth and prosthetic restorations. Porter et al. reported that fully or partially dentured residents had difficulties cleaning their teeth/removable dental prostheses, while no edentulous residents reported

such difficulties [33]. However, references are limited in the literature, because oral hygiene of edentulous jaws is challenging to evaluate objectively.

In the present investigation, significant correlations between DMFT value, place of residence, and four variables were analysed. DMFT value was the higher the longer last utilisation of dental services was delayed within the nursing home group. This finding is in line with Hopcraft et al., [22,29]. Consequently, more nursing home residents (edentulous excluded) had caries (68.3%) than home residents (58.0%) and the proportion of decayed teeth was higher (nursing home residents: 13.0%, home residents: 27.2%).

The age of removable dental prostheses was higher with higher DMFT values in both groups. An explanation for this can be that a high DMFT value of 28 corresponds to an edentulous situation. In the present investigation, 32.9% (nursing home residents) to 40.5% (home residents) had a completely removable dental prosthesis in at least one jaw. Niesten et al. stated that a high proportion of older people are convinced that 'dentures are unavoidably uncomfortable' and complicated by increasing age and disease [26]. In contrast, 77.6% (home residents) to 80.9% (nursing home residents) of participants in this investigation stated that they were satisfied with their oral situation.

Significant correlations were also analysed for the condition of the oral mucosa and the oral hygiene. Condition of the mucosa and the oral hygiene were better the higher the DMFT value was in both groups. In the present investigation, one third of all residents had no teeth and edentulous individuals were more frequently found to have good oral hygiene and condition of the mucosa is in line with the assumption mentioned before; an edentulous jaw might be easier to clean for an older person or a caregiver. In addition, oral mucosal lesions in edentulous (or partly edentulous) older individuals are mainly related to poor fitting or inadequately maintained removable dental prostheses [21,41].

A strength of the present investigation is the evaluation of the multi-morbid high-maintenance population living at private homes. In addition, by simplifying the questionnaire as much as possible, the inclusion of cognitively impaired participants could be realised. Furthermore, findings of the interview and intraoral examination were immediately entered into tablet computers during the process. The application did not allow any implausible correlations and could ensure a high quality of data.

One limitation of the present investigation refers to the study design. The study design of this investigation is a cross-sectional evaluation. In general, enrolling and including participants who belong to a multi-morbid and high dependency population poses a certain challenge for clinical evaluations. In particular, older people in long-term care living at private homes are less frequently included in clinical studies. Dissimilar to nursing homes residents, older people living at private homes are much more challenging to contact. Additionally, the team of dentist and dental nurses had to visit the participants at their place of residence individually. This process entails a high level of personnel effort, a large period and logistical preparation. Even after an initial contact and appointment, many older people do not attend the appointment or are not available at home, because of multiple reasons. Therefore, the team of dentist

and dental nurses had to visit the older people living at private homes more than one time. This also includes a high rate of drop out. Consequently, logistics of investigations with older people living at private homes is much more time-consuming, elaborate, and challenging than investigation focused on older persons living in nursing homes. These aspects represent the reason why the group of home residents is rather small. On the other hand, even though the number of cases seems rather small, it is nevertheless comparatively high in the context of current scientific literature.

Another limitation of the present evaluation is the influence of multiple factors, that affect the findings. Therefore, it is recommended to be interpreted and evaluated the results with caution. In particular, findings related to age should be viewed with caution in light of the fact that the average age of the groups differs by approximately three years. Another influencing factor is the reliability of participants' statements. Because of reduced cognitive functions and decreasing memory, questions might not have been answered correctly. The results of the questionnaire are also highly subjective and influenced by several variables. Response bias can be socially desirable responding and primacy/recency effects [42,42]. In addition, the presence of a dentist and a dental assistance might have bias on participants' statements [44]. Another restriction is the limited comparability with other clinical studies because no international score, for example the Oral Health Related Impact Profile or Nottingham Health Profile [45] was used within the questionnaire. The use of the DMFT Index is also not optimal for this aged investigation cohort. A high DMFT value can point in different directions. For example, DMFT of 28 can indicate either many teeth affected by caries or an edentulous situation, representing completely different dental treatment requirements.

Further investigations to analyse the oral health situation of older adults living at private homes or in nursing homes, using international scores, are highly recommended.

## Conclusion

1. Home residents were older than nursing home residents were, and women were older than men were.
2. Participants' last utilisation of dental services was delayed for years, especially for nursing home residents.
3. Most participants stated that they were satisfied with their personal oral situation.
4. Statistically significant correlations between (1) DMFT value, (2) place of residence, and (3) dental services use/age of removable dental prostheses/condition of the oral mucosa/condition of the oral hygiene were found.

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