Scientific Research Report

Oral Health of Older Patients in Dental Practice: An Exploratory Study

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ARTICLE INFO

Article history:
Received 28 December 2020
Received in revised form
11 May 2021
Accepted 12 May 2021
Available online 6 July 2021

Key words:
Community-dwelling older people
Characteristics
Oral Health status and Dental visits

ABSTRACT

Background: Some older people stop visiting the dentist when they get older. This study aims to identify the characteristics and oral health status of older people who do visit community dental practices.
Methods: In this exploratory cross-sectional study, the oral health of Dutch community-dwelling older people was assessed. A random sample of general dental practitioners and older people who visit the dental practice was drawn. The dentists were asked to prospectively select one older patient and describe this patient using a specially developed registration form; the patient was requested to complete a questionnaire. Data were described for 3 distinct groups of older people. Statistical measures for distribution and dispersion were used to describe the oral health of community-dwelling older patients in relation to the age.
Results: A total of 373 (40.4%) dentist registration forms and 372 (40.3%) patient questionnaires were returned. Data were available for 364 (39.4%) dentist–patient couples. Amongst the patients, 52.8% were female and most had a high socioeconomic status. About 65.7% had one or more problems related to general health, and 75.2% used medication. Regarding the overall oral health status, the average number of teeth was 20, 3.5% were edentulous. Oral health problems were more common in the older patient group (aged 75+), in whom frailty was also most common.
Conclusions: Older people who visit community dental practices are still relatively healthy, non-frail, and highly educated. Even in this group, there is a turning point in both general and oral health from the age of 75.

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Introduction

In many Western countries, the population is aging; older individuals live independently for an extended period, and many of them retain their own teeth into old age.[1,2] The increasing frailty of older people due to chronic conditions increases their dependence on care, which is often associated with oral health problems because maintaining proper oral hygiene becomes difficult as well.[3-6] The oral health of community-dwelling older people is often described mainly on the basis of self-reported information.[7-14] A study by Hoeksema et al. showed that the oral health of community-dwelling, frail older people was rather poor, and only 53% of the older people they examined had been to a dentist in the 2 years prior to the study.[15] This reduced frequency of

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https://doi.org/10.1016/j.identj.2021.05.003

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dental visits was also confirmed in a study by Astrom et al. amongst people aged 50 to 65 years that demonstrated that the frequency of regular dental visits decreases with age.[16] This may be associated with various barriers, including mobility issues, anxiety, ignorance, costs, a lack of knowledge, and a nonproactive attitude of oral health care providers.[17,18] However, for the maintenance of good oral health in older people, regular dental visits are important so that changes in oral health are recognised in time and may be addressed.[6] Research on dental care utilization shows that diagnostic services and prevention decline with age and that older patients visit the dentist chiefly for restorative procedures owing to caries, followed by prosthetics and periodontal treatment.[19-22]

Nevertheless, little is known about the problems for which older patients continue to visit the dentist and what their characteristics are in terms of general health and oral health. Therefore, the objective of this descriptive study is to identify these characteristics by examining the demographic characteristics, morbidity, and frailty of these older patients and investigate their oral health status on the basis of their current health status.

Methods

Study design

This exploratory, cross-sectional study examined the oral health of community-dwelling older people, living in their own home environment, who continue to visit a dental practice. Moreover, the study assessed their oral health care needs and the care provided by the dentist. A representative sample of general dental practitioners in the Netherlands were asked to randomly select one older patient from their files and describe this patient using a specially developed recording form and to ask the patient to complete a written questionnaire. To ensure random selection, dentists were instructed to take the first prospective patient according to the appointment schedule who was aged either 75 years or older or 60 to 64 years old. The patient could be included if they had visited the dentist for an examination or treatment in the past 2 years. The study distinguished between these 2 groups of older patients because the aim was to be able to make a clear comparison between "younger" old people and "older" old people.

The design, selection of research items, and execution of this study have been described in detail in a previous study by Bots-VantSpijker et al.[23]

Recruitment of dentists and data collection

A representative sample of 3000 dentists was drawn from the total population of 8656 dentists aged 64 or younger who lived and/or worked in the Netherlands. They received an information letter about the study, stating that they would be contacted by phone within 1 week to provide further explanation of the study.

In response to this letter, 74 dentists indicated that they did not want to be contacted. Of the remaining 2926 dentists, 1391 could not be contacted by phone (wrong number or could not be reached after 3 attempts); a full phone conversation was held with 1535 dentists. Of the 1535 dentists who were approached, 923 were willing to participate in the study. The other 612 dentists decided not to participate in the study, usually because they had no suitable patients in their practice or because they had no time to participate. Of the 923 dentists, 598 were asked to include a patient aged 75 years or older in the study, and 325 were asked to include a patient aged 60 to 64 years. Both the dentist and the patient received an information letter and an informed consent form.

Research instruments

The registration form for the dentist asked for information such as previous medical history and previous dental history and included questions about dental visits in the past, diagnoses, treatment strategy, and treatments provided. Additionally, the dentists were asked about some characteristics of their practice.

The patient questionnaire included general questions such as marital status and socioeconomic status (SES), supplementary dental insurance, and tobacco use and alcohol consumption. Additionally, questions were asked about medication, frailty, oral self-care, and dental visits, and questions about their perceived oral condition and any wishes regarding oral health.

A translated recording form for dentists and translated patient questionnaire may be requested from the first author.

Data processing and statistical analysis

The completed questionnaires and registration forms were entered into data files in an encoded form by an independent research institute. The researchers were then given exclusive access to the files with the coded research data, in which the patients and dentists participating in the study were not recognisable in any manner. The study distinguished between 2 groups of older patients: patients aged 75 years and older and patients aged 60 to 64 years. The first group was further divided into 2 groups. Thus, the older patients in this study were classified into 3 age groups: younger old (group A = 60-64 years), average old (group B = 75-79 years), and older old (group C = 80 years and older). However, 10 (2.7%) patients were 65 to 74 years old, 5 of whom were 65 years old. Considering the cutoff of 64 years, it was decided to include those 5 patients with the younger old patients (aged 60-64 years) because it was likely that their age was 64 years when they were selected. For clarity, the age category of younger old patients was changed to 60 to 65 years. The remaining 5 patients were excluded.

The data regarding sex, marital status, supplementary dental insurance, presence of diseases, medication use, smoking, and alcohol consumption were dichotomised. Using data from the patient questionnaire, the SES of the patients was determined on the basis of their highest level of education (low/average/high) and/or their last profession using the International Standard Classification of Occupations classification.[24,25]

Frailty is often defined on the basis of clinical tests.[26-30] For the sake of feasibility in this study, which is based on

routinely available data and self-administered data, we chose a simple classification of the ability to perform activities of daily living[31] derived from the known measures of frailty. This ability was assessed on the basis of the sum score of 7 dichotomous items about mobility, care dependency, and care support (Cronbach's alpha = 0.756). An older person was deemed as frail if they responded affirmatively to 3 or more questions.

Data obtained from the dentists on replacement of natural teeth and type of dentures were dichotomised. Periodontal health was expressed using the Dutch Periodontal Screening Index,[32] and the treatment strategy was divided into 3 exclusive categories: construction, preservation, and reduction.

The standard statistical measures for distribution and dispersion were used for describing the data about the oral health of community-dwelling older patients in relation to age. Not all information requested was provided by dentists and patients; however, in all cases, the number of missing values was small. Therefore, it was decided to use pairwise deletion. It was considered important to use as much of the information provided as possible particularly because of the descriptive exploratory study design. Admittedly, different relationships were explored, but that was not a test of predetermined hypotheses. All data were processed, linked, and analysed using the statistical software package SPSS (IBM Corp, 2016).

Results

After repeated requests, 373 (40.4%) dentist registration forms and informed consent forms and 381 (41.3%) patient questionnaires and informed consent forms were returned. Data were available for 359 (38.8%) dentist–patient pairs.

Dentists in the study

Of the 373 dentists who responded, 37% were women, and mean age was 49.7 years (standard deviation = 10.8 years). Almost a quarter (24.1%) of the participating dentists were aged 39 years or younger, whereas 25.0%, 40.5%, and 20.4% of them were 40 to 49 years old, 50 to 59 years old, and 60 years or older, respectively. Almost all dentists (94.2%) graduated in the Netherlands. The dentists were active in practices that were distributed countrywide: 45.3% in the urban west of the country, 22.5% in the southern part, 23.9 in the eastern part, and 8.3% in the northern part of the country.

Older patients in the study

The total sample of 375 patients in this study was divided into 3 groups: group A (aged 60-65 years; 31.2%), group B (75-79 years; 34.4%), and group C (80 years and older; 34.4%). The average age of all older patients was 74.9 years (range = 60-96 years). The average patient age in group A, B, and C was 62.3, 77.1, and 84.2 years, respectively (see Table A in the online appendix).

Of the 375 older patients in the study, more than half (52.5%) were female, and two-thirds (66.0%) were married or cohabiting. Additionally, 53.8% had a high SES, and 72.0% of the patients had supplementary insurance for dental care. In terms of the incidence rates of pathologies and medication use, group A patients were healthier than group B and C patients. Group A patients were also more mobile and less dependent on regular family-based care or professional home care and can therefore be described as less frail than group B and C patients (Table 1).

Oral health and dental visits

A total of 3.6% of the patients were edentate and had a full set of dentures or, occasionally, full upper dentures combined with mandibular implant overdentures. Overall, the number of teeth varied from 0 to 31, with an average of 20.1 (Table 2 and Table B of the online appendix). This included an average of 8.6 occlusal units. The oral health of group A patients was better than that of group B and C patients. The patients in group A had the highest number of teeth on average as well as the highest number of undamaged teeth and occlusal units ($P < .05$). The number of carious lesions was lowest in group A ($P < .05$). The patients in this group did have the highest number of teeth with plastic restorations ($P < .05$), but in relation to the total number of teeth, there were no significant differences in comparison with the other groups. Additionally, the patients in group A wore significantly fewer frames in the lower jaw and/or conventional dentures in the upper jaw ($P < .05$). There were fewer differences between the age groups in terms of periodontal health (Table 3).

In the previous 2 years, the participants had visited their dentist 9.6 times on average, with no differences in visiting behavior amongst groups A, B, and C. The treatment strategy that was most commonly established for all age groups was conservation.

Discussion

As best as could be determined, this is the first descriptive study examining the oral health of community-dwelling older people in the Netherlands who still visit the dentist regularly; the results show that the majority of these older patients still had some of their own teeth and visited the dentist more than once per year on average. Furthermore, a majority had one or more diseases and used one or more medications, and a small number were dependent on support by a home care organisation. The older people who still visited the dentist were largely well educated, especially in comparison with the SES of all Dutch people aged 65 or older, of whom only 17% are in the highest SES level.[25,33] The majority had supplementary dental insurance.[34] If the financing of oral health care in the Netherlands were covered by basic insurance, it would likely benefit the oral health of older people.

Older patients from this study appeared to be healthier than the average older population in the Netherlands; the national figures show that more than 90% of people aged 75 years and older have at least one chronic disease.[35] The underrepresentation of older patients with a lower SES and without supplementary dental insurance was possibly due to insufficient awareness of the importance of good oral health, difficulties in visiting the dentist, or financial barriers.[36]

Table 1 – Characteristics of older people who regularly visit a dental practice.

			Group A, aged 60-65	Group B, aged 75-79	Group C, aged 80 or older	Total
No.			109-117	122-129	122-129	353-375
Demographic characteristics						
🧍	Female[†]		48.7%	55.8%	52.7%	52.5%
🧍	Married/cohabiting[†]	*	83.8%	66.4%	50.0%	66.0%
🧍	Socioeconomic status[‡]					
	- Low[§]		4.5%	9.5%	8.7%	7.7%
	- Middle		36.0%	40.5%	40.5%	39.1%
	- High		59.5%	50.0%	50.8%	53.2%
🧍	Supplementary insurance for oral health care[†,¶]	*	75.2%	78.7%	62.3%	72.0%
Morbidity						
🧍	One or more conditions[†]	*	47.4%	74.8%	73.6%	65.7%
	- Cardiovascular diseases[†]	*	21.9%	49.6%	53.6%	42.5%
	- Respiratory diseases[†]		7.0%	7.3%	12.0%	8.8%
	- Liver or gastrointestinal diseases[†]		1.8%	7.3%	4.0%	4.4%
	- Kidney diseases[†]		0.9%	0.0%	2.4%	1.1%
	- Endocrine disorders[†]		8.8%	13.0%	7.2%	9.7%
	- Rheumatic conditions[†]		7.9%	8.1%	12.0%	9.4%
	- Dementia[†]		0.0%	0.0%	2.4%	0.8%
	- Miscellaneous neurological conditions[†]		1.8%	8.9%	6.4%	5.8%
	- Psychological disorders[†]		8.8%	4.1%	2.4%	5.0%
	- Oncological conditions[†]		1.8%	6.5%	4.8%	4.4%
	- Other[†,‖]		12.3%	13.0%	12.8%	12.71%
🧍	Medication use[†]	*	49.6%	88.1%	86.3%	75.6%
🧍	Average number of medicines (SD)[#]	*	2.9 (3.0)	4.2 (3.4)	4.1 (2.5)	3.9 (3.0)
🧍	Smoking[†]		11.7%	8.7%	7.2%	9.1%
🧍	Alcohol consumption[†]		81.1%	74.8%	81.0%	78.9%
Care support, care dependence, and frailty						
🧍	Mean frailty (SD)[††]	*	0.2 (0.6)	0.7 (1.3)	1.1 (1.6)	0.7 (1.3)
🧍	- Low (score 0)[§]	**	84.1%	69.4%	52.4%	67.9%
	- Medium (score 1 or 2)		14.0%	20.9%	31.5%	22.5%
	- High (score 3 to 7)		1.9%	9.7%	16.1%	9.6%
🧍	Cannot care for themselves well[†]		3.6%	3.9%	4.7%	4.1%
🧍	Caring for themselves has become harder[†]	*	2.7%	15.0%	24.8%	14.6%
🧍	Cannot stand up independently[†]		2.7%	1.6%	4.7%	3.0%
	Walking aid used[†]	*	4.5%	18.0%	29.1%	17.8%
🧍	Cannot walk 400 meters without problems[†]		5.6%	12.7%	15.1%	11.4%
🧍	Regular family-based care[†]	*	1.8%	10.2%	20.6%	11.3%
🧍	Planned home care[†]	*	0.0%	10.2%	15.1%	8.8%

🧍 Patient questionnaire.

† Dummy variable (0/1), analysis of variance (ANOVA), *F* test.

‡ Socioeconomic status is determined based on the highest level of education (low, average, or high) or the last profession (low, average, or high) based on the International Standard Classification of Occupations-08 classification.

§ Chi-squared test.

¶ In the Netherlands, basic insurance covers some dental costs. Individuals can get supplementary insurance on their own initiative; this figure gives the percentage who have supplementary insurance.

‖ Orthopedic complaints (n = 14), urological complaints (n = 9), allergies (n = 9), viruses and/or hearing complaints (n = 5), osteoporosis (n = 3), balance problems (n = 2), Dupuytren's disease, sarcoidosis, Lyme disease, shingles, nosebleed.

276 of the older people used medication: 58, 111, and 107, respectively, for the distinct age groups.

†† Sum score of 7 variables about self-care, aids, and support, composing a total score for frailty; Cronbach's alpha = 0.756.

* ANOVA, *F* test: $P < .05$.

** Chi-squared test: $P < .05$.

Older people who still visit the dental practice are mainly community-dwelling, dentate older people. The Royal Dutch Dental Association (KNMT) estimates the percentage of edentates amongst people aged 75 years and older to be 39%, whereas in this study it was only 3.5%.[37] This is in accordance with previous research, which showed that dental visits by edentate older people are infrequent.[38-40]

This study also demonstrates that the oral health of dentate older patients is markedly different in the various age groups. As age increases, the mouth deteriorates in almost every aspect of oral health: fewer teeth, more lesions from caries, more periodontal problems, and fewer occlusal units are observed, even in the group who still finds it important to visit the dentist. Of course, it is natural that the older the mouth is, the more dental history will be present, with a concomitant higher chance of altered dentition. After all, caries and periodontitis affect the teeth to such an extent that extraction becomes necessary, which may explain the differences in the number of teeth and occlusal units amongst the different age groups. These conditions in combination with the patients' medical history, medication use, and frailty may also lead to a higher demand for care. There are some known relationships amongst general health,

Table 2 – Number of teeth in older patients who regularly visit a dental practice.

			Group A, aged60-65	Group B, aged75-79	Group C, aged 80or older	Total
No.			115	126	124	365
	Number of natural teeth	*				
	- 0 (edentate)		0.9%	4.8%	4.8%	3.6%
	- 1-9		2.6%	14.3%	16.9%	11.5%
	- 10-19		9.6%	23.0%	23.4%	18.9%
	- 20-24		21.7%	24.6%	32.3%	26.3%
	- >24		65.2%	33.3%	22.6%	39.7%
	Mean	**	24.5 (5.4)	18.7 (8.3)	17.7 (8.2)	20.1 (8.0)

Registration by dentist.

* Analysis of variance (ANOVA), *F* test: $P < .05$.
** Chi-squared test: $P < .05$.

disease status, and oral health. Our results do not contradict these known associations. For example, diabetes mellitus is strongly associated with periodontitis, especially if meatblic control is not adequate.[41] Additionally, periodontitis is associated with cardiovascular disease, whereas a poor general condition and chronic illnesses such as depression, Parkinsonism, and rheumatic conditions give rise to problems in achieving proper daily oral hygiene.[42-44] Moreover, increased medication use leads to a decrease in the quantity and quality of saliva, which causes poor self-cleansing, caries—in particular cervical caries—and an increased risk of periodontal inflammation and *Candida* infections.[45,46] Taken together, these previous findings may explain the relatively high number of dental visits, which was at least 2 times higher than the national average of 2 dental visits per year, for all age groups.[40,47]

However, the age of 75 years could be seen as a turning point. In particular, the group 80 years and older had, in many respects, significantly poorer oral health than the group aged 60 to 65 years. However, more systemic diseases, greater medication use, and higher frailty was observed in the oldest age groups. Therefore, with increasing age, which is associated with a higher risk of oral health problems, higher medication use, and the first signs of frailty, it is essential to anticipate and use additional preventive measures to maintain good oral health.[6] Considering the trend observed in this study, in which individuals from lower-SES groups visit the dental practice less frequently, it is to be expected that the oral health of those older people who no longer visit the dentist is even poorer.

Limitations

This study has certain limitations. Because of the study design, the dentists contacted their older patients for participation. It is likely that the dentists looked preferably for older patients who could properly answer the questionnaire. This may have led to an overrepresentation of well-educated older people and confirmation of the idea that this group in particular continues to visit the dental practice.

The response rate of 40.4% of dentists was acceptable, but the number of participating dentists was considerably lower than the number of dentists who had agreed to be involved. With prior approach by phone, an attempt was made to achieve as high a response as possible.[48,49] However, after agreeing to participate in the study, some dentists found it more challenging than expected to select an older patient and to provide the requested information.

The dentists who participated in the study were mostly male and generally slightly older than the overall population of dentists in the Netherlands; the oldest group of dentists (aged 55-64 years) was overrepresented, which also explains the higher percentage of men in this study.[50] This overrepresentation of the older group might have had an effect on the representativeness of the study results. However, younger dentists may have fewer treatment relationships of 2 years or more with older patients, making it more difficult for them to select an older patient for the study.

Conclusions

This study demonstrated that older people who continue to regularly visit the dentist experience more oral health problems as they get older. Moreover, general health problems and correspondingly medication use increase with advancing age. In this respect, the age of 75 years appears to be a turning point. If this is observed in older people who continue to visit the dental practice, the need for this must even be greater amongst those frail older people who no longer manage to visit the dentist. Previous research confirms this view.[11]

Furthermore, early warning signs provided by regular dental visits help in preventing oral health deterioration in community-dwelling, frail older people and thereby contribute to their quality of life.[51]

Further studies are needed to better understand the turning point in general health and oral health and to be able to advise dentists specifically on how to optimise dental care for community-dwelling older people. Additionally, it is important to consider what needs to be done to reach the group of community-dwelling older people who no longer visit the dental practice.

Disclosures

Ethical approval and consent to participate: In the Netherlands, according to the Medical Scientific Research involving Human Subjects Act (WMO) for research in which research data are obtained by studying medical records, a non-WMO declaration is desirable. The Medical Ethical

Table 3 – Oral status, strategy, and number of visits of dentate older patients who regularly visit a dental practice.

		Group A, aged60-65	Group B, aged75-79	Group C, aged 80or older	Total
N		114-115	111-120	113-120	348-355
Condition of natural teeth					
Number intact (SD)[†]	*	9.2 (4.6)	6.7 (4.2)	5.4 (4.6)	7.1 (4.7)
Number with caries (SD)[†]		0.4 (1.6)	0.8 (2.6)	0.7 (1.9)	0.6 (2.1)
Number with synthetic restoration (SD)[†]	*	11.3 (5.2)	8.9 (6.1)	8.5 (4.9)	9.6 (5.5)
Number with indirect restoration (SD)[†]		4.2 (4.6)	3.9 (4.7)	4.3 (4.4)	4.1 (4.5)
Number with worn down to dentine (SD)[†]	*	1.5 (3.0)	3.0 (5.0)	2.8 (4.4)	2.4 (4.3)
Number with root remnant (SD)[†]		0.0 (0.1)	0.2 (1.4)	0.2 (0.9)	0.1 (0.9)
Replacement of natural teeth					
Etch bridge[‡]		1.7%	1.8%	5.9%	3.1%
Bridge[‡]	*	20.0%	33.3%	31.1%	28.1%
Implant[‡]		8.7%	8.8%	6.7%	8.1%
Type of dentures					
Upper frame prosthesis[‡]		4.4%	10.0%	13.3%	9.3%
Lower frame prosthesis[‡]	*	7.8%	17.5%	25.8%	17.2%
Partial upper plate prosthesis[‡]		5.3%	10.2%	5.9%	7.1%
Partial lower plate prosthesis[‡]		3.5%	3.4%	3.4%	3.4%
Full upper dentures (conventional)[‡]	*	4.4%	18.3%	20.0%	14.4%
Full lower dentures (conventional)[‡]		0.0%	1.7%	1.7%	1.1%
Full upper dentures (implant)[‡]		-	-	-	-
Full lower dentures (implant)[‡]		-	-	-	-
Has some dentures[‡]		18.4%	44.9%	50.2%	48.5%
Oral condition					
Number of teeth (SD)[†]	*	24.5 (5.0)	19.7 (7.3)	18.4 (7.4)	20.8 (7.2)
Proportion teeth with caries (SD)[†]	*	1.4 (5.3)	4.0 (11.4)	4.8 (14.6)	3.4 (11.2)
Proportion teeth with plastic restoration (SD)[†]		47.4 (20.2)	44.8 (25.8)	50.4 (26.1)	47.5 (24.2)
Periodontal health (DPSI)[§,¶]					
- A		39.5%	34.3%	45.1%	39.7%
- B		40.3%	35.1%	29.2%	34.9%
- C		20.2%	30.6%	25.7%	25.4%
Number of occlusal units[§,‖]					
- 0-4	**	4.1%	5.7%	16.4%	8.2%
- 5-8		35.1%	45.3%	43.6%	40.7%
- 9-12		60.8%	49.0%	40.0%	51.1%
Mean number (SD)[†]	*	9.1 (2.6)	8.7 (2.7)	7.7 (3.0)	8.6 (2.8)
Dental practice visit					
Number of visits in the previous 2 years (SD)[†]		9.4 (5.0)	9.6 (5.5)	9.7 (4.9)	9.6 (5.1)
Care provided during last dentist's visit					
Treatment strategy[§]					
- Construction		5.2%	5.0%	3.3%	4.5%
- Preservation		91.3%	86.7%	85.8%	87.9%
- Reduction		3.5%	8,3%	10.8%	7.6%

Registration by dentist.

[†] Analysis of variance (ANOVA), *F* test.
[‡] Dummy variable (0/1), ANOVA, *F* test.
[§] Chi-squared test.
[¶] The Dutch Periodontal Screening Index (DPSI) recognises 3 categories of patients:(A) Patients who require only oral hygiene instruction and calculus removal (DPSI 1: bleeding pockets 3 mm; DPSI 2: supra− or subgingival calculus).(B) Patients who require a limited periodontal examination in order to be able to make a proper treatment plan (DPSI 3^{-}: presence of pathological pockets of 4-5 mm without gingival recession).(C) Patients who require an extensive periodontal examination in order to be able to make a proper treatment plan (DPSI 3^{+}: presence of pathological pockets of 4-5 mm with gingival recession and DPSI 4: presence of pathological pockets ≥6mm.).[25]
[‖] No data available for 184 older people: 68 have full dentures, 79 have a frame and/or a partial denture, 37 made an unreliable statement (number of occlusal units >12), and 4 did not provide any data; therefore, the values of n for the various groups are 74, 53, 55, and 182.
* Analyses of variance (ANOVA), *F* test: $P < .05$.
** Chi-squared test: $P < .05$.

Committee of the Free University Amsterdam (Vrije Universiteit Amsterdam) has provided such a non-WMO-declaration in July 2016 (016.193: Bots-van 't Spijker Title: "De zorg aan oudere patiënten in de tandartspraktijk"). To guarantee the confidentiality for the processing of the data for this study and to safeguard the anonymity of the participants, an independent research agency ("Third Party Research Institute") was employed. Commissioned by the Royal Dutch Dental Association, this agency, KBA in Nijmegen (KBA, 2018)[52] takes care of the data collection and data processing for studies in dental practices. KBA is a member of a national Association for Policy Research[53] is the International Organization for Standardization-certified (ISO-9001: 2008) and carries out the work activities in compliance with a legally mandatory data processing agreement.

Availability of data and materials

The data sets used during the current study are available from the corresponding author on reasonable request.

Author contributions

We affirm that everyone who contributed significantly has been listed and we did receive a written consent from all authors. Below, you will find the list of all authors' contributions:

- Study concept and design PCBVTS, CDMW, JMGAS, JJMB
- Acquisition of data: PCBVTS, JJMB
- Analysis and interpretation of data: PCBVTS, CDMW, JMGAS, JJMB
- Drafting of the manuscript: PCBVTS, JJMB
- Critical revision of the manuscript for important intellectual content: PCBVTS, CDMW, JMGAS, JJMB
- All authors read and approved the manuscript: PCBVTS, CDMW, JMGAS, JJMB

Funding

The manuscript describes data that were collected within the Data Station Project of the Royal Dutch Dental Association (KNMT). In 1995, the KNMT has initiated the periodic collection of data with regard to working and practical conditions of general dental practitioners.[53,54] Therefore, the KNMT has borne the costs with regard to the data collection; also as an incentive to stimulate research in general dental practices. The collection of the data is part of a PhD research project, which is carried out "pro deo."

Conflict of interest

None disclosed.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.identj.2021.05.003.

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