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Scientific article

Oral health status and complete denture status of independent-living Singaporean elderly residing in a community home



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ABSTRACT

Aim: Past studies have examined the oral health status of elderly Singaporean adults residing in long term care facilities and living in residential housing but no oral health research has been conducted on elderly Singaporeans residing in community homes. The aim of this paper is to report on the oral health status and complete denture status of a group of free living (community dwelling) elderly in Singapore from the AWWA Community Home for Senior Citizens, and investigate the relation between the clinical findings and demographic data.

Materials and methods: This research used a cross-sectional design and was conducted in the month of December 2011. Consenting residents of the AWWA home who were over the age of 60 participated in this study. Sampling strategy was census. Two calibrated interviewers collected demographic information from the participants and four calibrated dentists conducted extra-oral and intra-oral soft tissue examinations along with assessment of dentition, periodontal and denture status.

Statistical analysis: All data were input into Microsoft Excel 2010™ and analysed in SPSS 21.0™. Descriptive analysis and bivariate analysis were performed on the demographic factors and other variables of interest. The Spearman's test, Mann-Whitney U and Chi-Square test were used to examine the correlation between the clinical findings and age, gender and education level respectively.

Results: Among the 70 participants, two subjects (2.9%) had complete dentition, 34 (48.6%) were partially dentate, and 34 (48.6%) had no teeth. The mean number of teeth among the partially dentate participants was 11.28 while the mean number of anterior, posterior and total occlusal contacts were 1.61, 2.17 and 3.78 respectively. The mean number of decayed teeth (DT) and filled teeth (FT) were 2.81 and 0.25, giving a mean DFT score of 3.06. The mean Root Caries Index was 0.13. Periodontal examination revealed that only 5 (13.9%) individuals had healthy periodontal tissues, while 2 (5.6%) had the highest score of 1, 9 (25.0%) had the highest score of 2, 11 (30.6%) had the highest score of 3 and 7 (19.4%) had

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the highest score of 4. Amongst the partially dentate, 14 had dentures and 20 had none. There were 34 edentulous participants and 23 had at least one denture while 11 did not have any complete dentures. The most frequent unsatisfactory finding for complete dentures was inadequate retention of the mandibular dentures. When the dentures were grouped into those that were satisfactory and those that had at least one unsatisfactory factor, 11 of the 26 maxillary dentures and 17 of the 23 mandibular dentures fell to the latter category. Analysis revealed that there was a correlation between age and the number of teeth with a correlation coefficient of -0.43 ($p=0.01$) and age with the mean DFT, -0.33 ($p=0.05$).

Conclusion: The findings of this study revealed a high treatment need for this group of elderly.

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Introduction

Singapore has one of the world's fastest ageing populations, with the proportion of elderly adults rising from 10.5% of the total population in 2013 to almost 20% of the total population by 2030 [1]. By 2030, it is estimated that the number of seniors above 65 in Singapore will increase to almost one million. One of the challenges with an ageing population is ensuring that the needs of the elderly, including their oral health needs are well provided for. Studies have shown that oral health can have a significant impact on the general health and quality of life of individuals; therefore, public health policies need to take into consideration the oral health status and needs of the elderly population [2,3]. This will encourage active and healthy ageing amongst the elderly population.

Peer-reviewed reports on the oral health of the elderly in Singapore date back to the 1990s. Soh et al. examined the status of the dentition, soft tissue and periodontium of 479 institutionalized elderly living in long-term care facilities and found that the mean DMFT for the cohort was 27.0 [4]. Fifty-six percent of the elderly were edentulous and 78.8% were without dentures. They also found that 52.2% of the subjects presented with a dental condition that required immediate care. Loh et al. studied the oral health of 891 elderly residential residing adults and found that the percentage of edentulous individuals was 27.3% and there was a significant difference in the percentage of edentulous individuals in the different age groups [5]. The mean DMFT of the elderly in their study group was 19.4 and showed an upward trend with each increasing age cohort. Thean et al. found the treatment needs of 184 nursing home residents to be high [6]. More than half the complete dentures examined were unsatisfactory and untreated decay and retained roots were prevalent.

Currently, there is not any information on the oral health status of elderly Singaporeans residing in community homes. In 2011, about 97 per cent of the elderly population resided in residential housing, while the remaining were living in institutions such as community and nursing homes [7]. Community homes, also known as sheltered homes, provide residential care for ambulant destitute or low-income elderly who are without family support and can live independently while nursing homes provide care for the elderly with medical conditions who need nursing care. This paper reports on

the oral health status and complete denture status of a group of elderly Singaporeans residing in the AWWA Community Home for Senior Citizens, and investigates the relation between the clinical findings and demographic data.

Materials and methods

This research used a cross-sectional design and was conducted in the month of December 2011. The participants of this study were free-living residents of the Asian Women's Welfare Association (AWWA) Community Home for Senior Citizens. Sampling strategy was census, as all the residents over the age of 60 years were invited to participate. The study was explained to the residents and written consent was obtained from all volunteer participants. Those unable to answer the questionnaire were excluded from the study. The participants were given an oral care kit as a token of gratitude for their participation. Ethical approval to conduct this research was received from the National University of Singapore Institutional Review Board, Reference Code 10-155.

Two calibrated interviewers collected demographic information and four calibrated dentists performed the clinical examinations on the participants. Demographic data collected included information regarding age, gender, level of education, number of years in Singapore, and monthly income. Clinical examinations were carried out on location using portable headlamps, mouth mirrors, CPI probe with 0.5 mm ball end, magnifying loops (Heine HR 2.5 × S frame), with the participants reclining on portable dental chairs. Clinical examination included extra-oral and intra-oral soft tissue examination along with assessment of dentition, periodontal and denture status.

Dentition status included the presence of natural teeth, the number of posterior and anterior occlusal contacts and presence of caries. The number of occlusal contacts was observed by asking the participant to bite in maximum intercuspation. The number of posterior contacts counted the presence of contacts on mandibular premolars and molars while the number of anterior tooth contacts was counted by observing the number of contacts achieved on the mandibular anterior teeth. Dental caries was assessed using criteria described in ICDAS-2 with mouth mirrors, CPI

probes with a 0.5 mm ball tip, and headlamps [8]. ICDAS Caries codes 0 and 1 were not differentiated, as compressed air was not used for the examinations, but the rest of the codes and criteria were applied. Both coronal and exposed root surfaces were scored for the presence of caries and restorations. For this report, the scores were converted to decayed and filled surfaces, while missing surfaces are not reported due to recall error by the participants. For root surfaces, the findings are reported using the Root Caries Index [9].

Periodontal status was assessed using the Community Periodontal Index (CPI) according to the WHO methodology using a CPI probe with a 0.5 mm ball tip [10]. The scoring system is shown in Table 1. The mouth was divided into six sextants defined by teeth numbers 18-14, 13-23 24-28, 38-34, 33-43, and 44-48 and a sextant was examined only if there were two or more teeth present and not indicated for extraction. The two molars in each posterior sextant are paired for recording, and if one is missing, there is no replacement. If no index tooth was present in a sextant qualifying for examination, all the remaining teeth in that sextant were examined.

Complete dentures were assessed for retention, stability, defects and occlusion. Retention of maxillary dentures was assessed with the examiner placing his index finger and thumb in the premolar areas and exerting a gentle vertical downward pressure while for the mandibular dentures the index finger and thumb of one hand were used to grip either side of the central incisors and a gentle upward force was exerted [4]. Stability was assessed with the examiner placing their index fingers and thumbs on either side of the premolars and applying rotatory and lateral forces on the complete denture. Occlusal relationship was recorded by asking the patient to bite down from his resting position, with the examiner gently supporting the lower denture with his index fingers. The relationship was recorded as inadequate if there was a slide of greater than one quarter cusp length into intercuspal position from first contact, if first contact was uneven, leading to displacement of the dentures on further closure or if first contact was clearly uneven between right and left or where all contact was on the anterior teeth, even in the absence of significant displacement. Defects in the form of broken teeth, missing teeth, fractured base and deficient base were noted for both maxillary and mandibular complete dentures. A score of 0 was given for each of the items if the item assessed was

Table 1 – CPI scoring system.

Score	Description
0	Healthy
1	Bleeding observed, directly or by using mouth mirror, after sensing
2	Calculus felt during probing but all the black area of the of probe is visible
3	Pocket 4 or 5 mm (gingival margin situated on black area of probe)
4	Pocket >6 mm (black area of probe not visible)
X	Excluded sextant
9	Not recorded

satisfactory and a score of 1 was given if the examination showed unsatisfactory findings. The scores were then tabulated to reflect the denture status and higher scores were associated with more problems with the complete dentures. Partial dentures were examined for the Kennedy classification, type of support, and retention. However, due to the variability of partial dentures, the status of partial dentures is not reported in this paper.

Data analyses

All data were input into Microsoft Excel 2010™ and analysed in SPSS 21.0™. Descriptive analysis and bivariate analysis were carried out for the demographic factors and other variables of interest. The Spearman's test, Mann-Whitney *U* and Chi-Square test were used to examine the correlation between the clinical findings and age, gender and education level respectively.

Results

Demographic distribution

Seventy participants were recruited in this study (47 (67%) males; 23 (33%) females). The demographic distribution of the study population is shown in Table 2. The mean age of the participants was 74.4, with the oldest being 91 years of age. Sixty-four (91%) were Chinese, 5 (7%) were Malays and there was 1 (1%) Indian participant. Whilst 19 (27%) of the participants had no formal education, 32 (46%) had up to primary

Table 2 – Distribution of some socio-demographical characteristics of elderly subjects (n=70).

Demographic variables	n (%)
Gender	
Male	47 (67.1)
Female	23 (32.9)
Age	
60-69	15 (21.4)
70-79	34 (48.6)
80 and above	21 (30.0)
Ethnicity	
Chinese	64 (91.4)
Malay	5 (7.1)
Indian	1 (1.4)
Education level	
No formal qualification	19 (27.1)
Primary school education	32 (45.7)
Secondary school education	18 (25.8)
Professional qualification	1 (1.4)
Marital	
Single	54 (77.1)
Married	12 (17.1)
Divorced	4 (5.7)
Monthly income	
No income	9(12.9)
Up to \$999	61 (87.1)

school education, 18 (26%) had up to secondary school education, and only 1 had a professional qualification. Fifty-four (77%) of the participants were single, 12 (17%) were married, and 4 (6%) were divorced. The majority of the participants, 61 (87%) were engaged in the work force and only 9 (13%) were not.

Prevalence of edentulism and denture usage

Amongst the participants, 4 (5.7%) had all maxillary teeth present (with the exception of the third molars) and 2 (2.9%) had intact mandibular dentition. Twenty-five (36%) were partially edentulous on the maxillary arch and 12 of them had partial dentures. For the mandibular arch, 32 (46%) were partially edentulous and 7 had partial dentures. Forty-one (56%) of the participants were edentulous on the maxillary arch and 26 had complete denture prosthesis. On the mandibular arch, 36 (51%) were edentulous and 23 had complete denture prosthesis. Two subjects (2.9%) had complete dentition, 34 (48.6%) were partially dentate, and 34 (48.6%) were edentulous. Amongst the partially dentate, 14 had dentures and 20 had none. Amongst the edentulous participants, 23 had at least one denture and 11 did not have any complete dentures. [Table 3](#) summarises the data on prevalence of edentulism and denture usage.

Dentition status

Of the 70 participants, 34 were edentulous; thus, only 36 were included in the examination and analysis of dentition status.

The mean number of teeth was 11.28. The mean number of anterior, posterior and total occlusal contacts were 1.61, 2.17 and 3.78 respectively. The mean number of decayed teeth (DT) was 2.81 while that of filled teeth (FT) was 0.25, giving a mean decayed and filled teeth (DFT) score of 3.06. The mean RCI index was 0.13. [Table 4](#) shows the dentition status of the 36 dentate participants. There was a correlation between age and the number of teeth with a correlation coefficient of -0.43 ($p=0.01$) and age with the mean DFT, -0.33 ($p=0.05$). There was no correlation noted between age, gender and education level with the other factors considered in dentition status. The intra-class correlation for inter-examiner reliability was 0.94 for DT.

Periodontal status

[Table 5](#) shows the periodontal status of the participants according to CPI. Only 5 (13.9%) individuals had healthy periodontal tissues, while 2 (5.6%) had the highest score of 1, 9 (25.0%) had the highest score of 2, 11 (30.6%) had the highest score of 3, and 7 (19.4%) had the highest score of 4. There were no significant correlations noted between the highest CPI score and age, gender and education level.

Status of complete dentures and its relationship with demographic factors

The results for complete denture status are shown in [Table 6](#). For maxillary complete dentures, 18 (69%) had satisfactory retention and the remaining 8 were deemed unsatisfactory.

Table 3 – Prevalence of edentulism and denture usage according to arch.

	Maxillary arch n (%)	Mandibular arch n (%)
All teeth present (except 8s)	4 (5.7)	2 (2.9)
Partially dentate with denture	12 (17.0)	7 (10.0)
Partially dentate without denture	13 (18.6)	25 (35.7)
Complete edentulism with denture	26 (37.1)	23 (32.6)
Complete edentulism without denture	15 (21.4)	13 (18.6)
Total	70 (100)	70 (100)

Table 4 – Dentition status among the 36 dentate participants.

	Male (n=25) Mean (95% C.I.)	Female (n=11) Mean (95% C.I.)	Total (n=36) Mean (95% C.I.)
Number of natural teeth	10.6 (6.98–14.30)	12.7 (7.46–18.00)	11.28 (8.40–14.16)
Number of anterior occlusal contacts	1.6 (0.69–2.51)	1.63 (0.39–2.89)	1.61 (0.91–2.31)
Number of posterior contacts	2 (0.46–3.54)	2.55 (–0.45–5.54)	2.17 (0.84–3.49)
Total occlusal contacts	3.6 (1.25–5.95)	4.18 (1.00–7.36)	3.78 (1.97–5.59)
DT	3.32 (1.87–4.77)	1.64 (0.13–3.15)	2.81 (1.71–3.90)
FT	0.12 (–0.13–0.37)	0.55 (–0.15–1.24)	0.25 (–0.01–0.51)
DFT	3.44 (2.02–4.86)	2.18 (0.69–3.68)	3.06 (1.99–4.12)
No. of root surfaces with decay	0.68 (–0.35–1.71)	1.36 (–0.66–3.39)	0.89 (0.00–1.78)
No. of root surfaces with permanent fillings	3.12 (0.37–6.20)	2.55 (0.14–4.96)	2.94 (0.75–5.14)
No. of sound root surfaces	23.08 (16.04–30.11)	31.27 (17.69–44.86)	25.58 (19.44–31.73)
Root Caries Index	0.13 (0.06–0.21)	0.12 (0.03–0.20)	0.13 (0.07–0.19)

Table 5 – Periodontal status according to CPI, in relation to gender (n=36).

	Number of subjects with highest score of					Mean number of sextants scores					
	0	1	2	3	4	0	1-4	2-4	3-4	4	X
Male	4	1	3	11	6	0.36	2.44	2.08	0.88	0.28	1.55
Female	1	1	6	2	1	0.45	2.55	2.18	0.36	0.09	1.43
Total	5	2	9	13	7	0.39	2.48	2.11	0.72	0.22	1.51

Table 6 – Status of 26 maxillary and 23 mandibular complete dentures.

	Maxillary n (%)	Mandibular n (%)
Denture retention		
Satisfactory	18 (69.0)	6 (26.0)
Unsatisfactory	8 (31.0)	17 (74.0)
Denture stability		
Satisfactory	22 (85.0)	14 (61.0)
Unsatisfactory	4 (15.0)	9 (39.0)
Defects		
Present	7 (27.0)	4 (17.0)
Not present	19 (73.0)	19 (83.0)
Occlusal relationship		
Satisfactory	17 (65.0)	
Unsatisfactory	9 (35.0)	

In terms of stability, 22 (85%) of the maxillary complete dentures were satisfactory while 4 (15%) were unsatisfactory. For mandibular complete dentures, only 6 (26%) had satisfactory retention, 14 (61%) had satisfactory stability, in contrast to the 17 (74.0%) and 9 (39.0%) which had inadequate retention and inadequate stability, respectively. Eleven out of the 49 complete dentures examined had defects. Seventeen (65%) of the 26 dentures had satisfactory occlusion with the opposing arch. When the dentures were grouped into those which were satisfactory and those which had at least one unsatisfactory factor, 11 of the 26 maxillary dentures and 17 of the 23 mandibular dentures fell to the latter category. The status of complete dentures was not related to age, gender or educational level.

Discussion

This is the first study in Singapore reporting on the oral health of independent residents of a community home. Unlike residents of nursing homes, these elderly were ambulant and active and studies have shown that active elderly tend to have better oral health than dependent elderly [11]. However, residents of community homes have limited financial income and as shown in Table 2, 72.8% of the participants in this study attained only primary school education and 61 (87.1%) reported monthly income up to \$999 while 9 (12.9%) reported no income. Low income and education level have been associated with poor oral health in the elderly, who tend to be underserved with regards to oral care [12]. In this study, no attempt was made to determine the correlation between

clinical findings and income level, since the participants had no or limited income. It is important to note that the findings of this study describe the oral health status of this unique group of elderly and should not be generalised to the general elderly population in Singapore. It does, however, reveal the need for oral health care amongst this group of elderly.

A high percentage of the participants (48.6%) in this study were edentulous and among those partially dentate, the mean number of natural teeth was 11.28 and the mean number of occluding contacts was 3.78 (Table 4). While it has been noted that globally the elderly are living longer and retaining more teeth, this trend might not be the case for elderly who are of low economic status [13]. Amongst the partially dentate, 20 (58.9%) of the partially dentate participants did not have any partial dentures and 23 (32.4%) of the edentulous participants had no complete dentures. This proportion was lower than the 94% of the partially dentate participants and 78.8% of the edentate participants who could have benefitted from prosthetic treatment in the study by Soh et al. [4]. The necessity of dentures may be questioned for partially dentate individuals, since the presence of dentures may increase the incidence of caries, periodontal problems and denture stomatitis in the absence of proper oral care. It has also been suggested that there was sufficient adaptive capacity in subjects with at least four occlusal units and that it was not necessary to restore an individual to complete dentition of 28 teeth [14]. On the other hand, dentures may aid in masticatory function, especially in subjects who have fewer than 3 occluding pairs of teeth, and help to improve aesthetics and thus self-esteem [15]. In this study population, given that the mean number of natural teeth and occluding contacts were low, participants may be able to benefit from the provision of partial dentures. The presence of complete dentures may also be beneficial for edentate individuals since the absence of complete dentures has been linked to the risk of malnutrition in edentate subjects [16].

A global survey by the World Health Organisation revealed a huge unmet need for denture treatment and restorative dental care amongst older people [12]. However, the provision of dental care based on normative treatment need alone might not be sufficient to determine if prosthetic treatment should be provided since the impact of missing teeth might not affect the functioning, social and psychological well-being of these individuals. Using the sociodental approach might provide a more relevant estimation of treatment need in the provision of dentures in the elderly population [17]. This approach involves identifying both normative needs and socio-dental factors, such as perceived impacts and oral health-related behaviours, and should be utilised in subsequent studies.

Complete denture examination showed that 17 out of the 23 mandibular prostheses had unsatisfactory retention. This is similar to the findings of the study by Thean et al. which showed that almost 50% of the complete dentures had inadequate retention [6]. The study by Soh et al. revealed that 20% of the complete dentures needed replacement due to inadequate retention or stability [4]. Elderly adults may be satisfied with the function of their poor fitting dentures since there may be a lack of association between clinicians' evaluation of dentures and patients' satisfaction [18]. In cases where it is difficult to achieve retention for mandibular complete dentures, it has been suggested that implant retained mandibular overdentures be considered and studies have shown that such an intervention can help to improve the quality of life of the elderly [19]. However, the increased cost and greater need of maintenance for implant-retained overdentures may deter the elderly from seeking this modality of treatment.

This study omitted the reporting of the mean number of missing teeth due to caries (MT) since it was difficult for the elderly to recall accurately the reasons for the extraction of their teeth; hence only mean DFT was reported. The study by Loh et al. on community-dwelling elderly found that the mean DT and the FT was 1.2 and 2.0 respectively [5]. The DT of 2.21 was higher in this study but the FT of 0.25 was much lower than the study by Loh et al. [5]. However, our values for DT and DFT correspond closely with those found in India and China [20,21]. The DT for a study amongst the elderly in India ($n=300$) was 2.5 and another study in China ($n=23452$) found the DFT to be 2.5. The mean DT of 2.81 and mean decayed root surface of 0.89 reflect a high treatment need for this group of independent living elderly. The low FT of 0.25 and high DT could be due to a preference for tooth extraction in older people or may reflect an underutilisation of restorative care due to various reasons. The use of professional dental services has been shown to be low amongst elderly adults, particularly among the socio-economically disadvantaged [22]. Dental caries is a major public health problem in older people and it is closely linked to social and behavioural factors such as irregular dental attendance and lack of proper oral hygiene habits [13]. This study also showed that the number of teeth and mean DFT were significantly correlated with age ($p=0.01$ and 0.05 respectively), similar to findings in other studies [23,24].

The high prevalence of subjects with the highest CPI score 2 and 3 has been noted in other countries as was the case for this study, where 61% of the participants had the highest CPI score 2 and 3, reflecting poor oral hygiene, while 19.4% had CPI-4, an indication of severe periodontal disease [12]. A study in Hong Kong among low-income middle-aged to elderly participants had results similar to this study, where 64.1% of the participants had the highest CPI score 2 and 3 while 35.9% had CPI-4 [25]. While age was not associated with the incidence of periodontal disease, earlier studies have shown that females and those with a higher level of education had better periodontal health [26,27]. However, this was not the case in our sample population and could possibly be due to the small sample size, resulting in a Type II error. The promotion of good oral self care and regular visits to dentists throughout the adult lifespan might be beneficial in

improving the oral health status of the elderly population. Oral hygiene education programmes targeting the elderly have been shown to improve self-care skills and may ultimately impact positively on the oral health status of the elderly [28]. This may result in the retention of more natural teeth, which has been associated with better oral-health quality of life of individuals [3].

6. Conclusion

The results from this study showed there is a great normative need for dental care in this group of elderly. There is also a significant correlation between age and the number of natural teeth and DFT ($p=0.01$ and 0.05 respectively).

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