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Oral health problems in elderly rehabilitation patients

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Abstract: A combination of poor oral hygiene and dry mouth may be hazardous to the oral health status. However, systematic assessments in order to detect oral health problems are seldom performed in the nursing care of the elderly. The aims of this study were to investigate the occurrence of oral health problems measured using the Revised Oral Assessment Guide (ROAG) and to analyse associations between oral health problems and age, gender, living conditions, cohabitation, reason for admission, number of drugs, and functional and nutritional status. One registered nurse performed oral health assessments using ROAG in 161 newly admitted elderly patients in rehabilitation care. Oral health problems were found in 71% of the patients. Thirty per cent of these patients had between four and eight problems. Low saliva flow and problems related to lips were the most frequent oral health problems. Problems in oral health status were significantly associated with presence of respiratory diseases (problems with gums, lips, alterations on the tongue and mucous membranes), living in special accommodation (low saliva flow, problems with teeth/dentures and alterations on the tongue), being undernourished (alterations on the tongue and low saliva flow) and being a woman (low saliva flow). The highest Odds ratio (OR) was found in problems with gums in relation with prevalence of respiratory diseases (OR 8.9; confidence interval (CI) 2.8–27.8; $P < 0.0005$). This study indicates the importance of standardised oral health assessments in order to detect oral health problems which can otherwise be hidden when the patients are admitted to the hospital ward.

Key words: elderly rehabilitation patients; gender; nursing care; oral health problems; respiratory diseases; revised Oral Assessment Guide; special accommodation; undernourishment

Introduction

Seventeen per cent of the Swedish population in December 2002 was over 65 years of age. The proportion of individuals ≥65 years is expected to increase to about 23% in 2030 (1). Approximately 40% of individuals aged between 75 and 84 years in Sweden were reported to have natural teeth in 1996/1997, and the percentage is predicted to increase to 90% in 2015 (2). The prevalence of general diseases increases with age (3). Arthritis, cardiovascular diseases, lung diseases and stroke, as well as the ageing process, are accompanied by a decrease in self-care capacity (4), such as the ability to perform oral hygiene (5). Furthermore, increased drug consumption is a common finding among elderly. One common side-effect of many drugs is a decreased salivary flow (6). A combination of poor oral hygiene and dry mouth may be hazardous to the oral health status (7). Caries, periodontal diseases and mucosal disorders have been demonstrated in the range of 50–100% among older patients at hospital (8–11). A poor oral health status may subsequently affect the nutritional status (12), as well as the general health status and well being (13).

The concept that the oral cavity is an integral part of the body and that oral microbes may be associated with the pathogenesis of systemic diseases was highlighted by Miller (1891; 14). Aspiration of oral microorganisms may contribute to the genesis of aspiration pneumonia (15). An association between oral microorganisms and respiratory diseases among frail elderly has been reported (16). Furthermore, an association between periodontitis and coronary heart disease (for review, see 17), as well as stroke (18,19), has been proposed. Decreased chewing capacity was associated to a deficient nutritional status (20). The above cited associations highlight the importance of good oral health, especially for frail elderly.

Oral care is, however, reported to have a low priority in the nursing care of elderly and systemic, and repeated assessments to detect oral health problems are seldom performed (21). It has been demonstrated that the use of an Oral Assessment Guide (OAG) may increase the nurses' awareness of oral health (22). The Revised OAG (ROAG) has been reported to be reliable and useful in detecting oral health problems and initiating appropriate oral health procedures among elderly rehabilitation patients (12, 23, 24). In spite of a short introduction to a registered nurse, the inter-rater reliability was found to be good between the nurse and a dental hygienist, implying that the tool was easy to use (23).

The aim of this study was to investigate the occurrence of oral health problems measured using the ROAG in elderly rehabilitation patients on admission. A further aim was to analyse associations between oral health problems and age, gender, living conditions, cohabitation, reason for admission, number of drugs, and functional and nutritional status.

Materials and methods

The study was carried out at a university hospital in south-east Sweden between November 1996 and January 1998. Three rehabilitation wards were involved: a heart and lung rehabilitation ward (H-LRW, November 1996–May 1997); an orthopaedic rehabilitation ward (ORW, April 1997–January 1998); and a general elderly rehabilitation ward (GERW, October 1997–January 1998). The patients came to the wards from the emergency clinic through a short-stay admission ward (mean stay 5 days). Patients with dementia came directly to the GERW. During the study, 166 patients ≥65 years were admitted to the wards. Five patients admitted to the H-LRW were excluded as the oral assessments were not performed. The remaining sample consisted of 161 patients.

Standardised oral health assessments were not performed at the ward before the initiation of this study. Before the start of the study, one registered nurse practised at the hospital dentistry and attended lessons in oral health given to students at the medical faculty. The registered nurse was trained in how to assess nutritional status. After initiation of the study, oral and nutritional assessments were performed by the nurse. Functional status was assessed by assistant nurses who had performed these assessments in the daily care before the initiation of this study.

Revised Oral Assessment Guide

The OAG, developed by Eilers *et al.* (25), for use among patients undergoing bone marrow transplantation and receiving high-dose radiation and/or chemotherapy, was revised to be used among elderly patients (for details, see 12, 23). Eight categories – voice, lips, mucous membranes, tongue, gums, teeth/dentures, saliva and swallowing – are included in ROAG (Table 1). Each category is described and rated from healthy (score 1) to severe oral health problem (score 3). Procedures to be performed when problems in oral health status were found are included in ROAG.

Assessment of nutritional and functional status

Subjective global assessment (SGA), a method developed by Detsky *et al.* (26), was used to assess nutritional status. The instrument includes history and physical examination, allowing a clinical grading of nutritional status. The patients' nutritional status is ranked in one of the following categories: (i) well nourished, (ii) well nourished but at risk of becoming undernourished, (iii) suspected of being undernourished or (iv) severely undernourished.

The patients' self-care ability was assessed by means of Katz's index of Activities of Daily Living (ADL; 27). The ADL index

Table 1. **Revised Oral Assessment Guide**

		Numerical and descriptive rating			
Category	Method	1	2	3	Procedures
Voice	Converse with the patient	Normal	Deep or rasping	Difficulty talking or painful	Consult doctor
Lips	Observe	Smooth and pink	Dry or cracked, and/or angular chelitis	Ulcerated or bleeding	Consult doctor or dentist
Mucous membranes Dentures removed	Observe Use light and mouth mirror	Pink and moist	Dry and/or change in colour, red, blue-red or white	Very red, or thick, white coating Blisters or ulceration with or without bleeding	Consult doctor or dentist
Tongue	Observe Use light and mouth mirror	Pink, moist and papillae present	Dry, no papillae present or change in colour, red, or white	Very thick white coating Blisters or ulceration	Consult doctor or dentist
Gums	Observe Use light and mouth mirror	Pink and firm	Oedematous and/or red	Bleeding easily under finger pressure	Support with oral care Consult dentist or dental hygienist
Teeth/dentures	Observe Use light and mouth mirror	Clean, no debris	Plaque or debris in local areas Decayed teeth or damage dentures	Plaque or debris generalised	Support with oral care Consult dentist
Saliva	Slide a mouth mirror along the buccal mucosa	No friction between the mouth mirror and mucosa	Slightly increased friction, no tendency for the mirror to adhere to the mucosa	Significantly increased friction, the mirror adhering or tending to adhere to the mucosa	Support with oral care Artificial saliva substitute
Swallow	Ask the patient to swallow Observe Ask the patient	Normal swallow	Some pain or difficulty on swallowing	Unable to swallow	Consult doctor

Modified from Eilers *et al.* (1988; 25) with permission from Nebraska Medical Centre.

summarises an individual's overall performance concerning six functions: hygiene, dressing and undressing, ability to go to the toilet, mobility, ability to control bowels and bladder, and food intake. The performance in the six activities is graded from 'A–G', or as 'O': 'A' means independent in all functions, 'B–F' means dependent in one to five functions in a specified hierarchical order and 'G' means dependent in all respects; 'O' (others) means being dependent on help in at least two and at most five activities, and cannot be classified as 'C–G' as the dependency in various functions does not follow the hierarchical structure of the index (27).

Nurses informed the patients about the study when admitted to the ward. It was stressed that participation was voluntary. The Ethics Committee of the University of Health Sciences, Linköping University (LiU 58–97) approved the study.

Statistical methods

Different rehabilitation wards were compared with chi-square test for nominal data, and with ANOVA for interval data. Age (0, 65–74 years; 1, 75–84 years; 2, ≥85 years) and length of hospital stay (0, <14 days; 1, ≥14 days) were categorised. Post-hoc pair-wise comparisons were adjusted by Bonferroni method (28). Univarite and multiple logistic regression analyses were used to explore associations with oral health status. The categories in ROAG (voice, lips, mucous membranes, tongue, gums, teeth/dentures, saliva and swallowing) were included as dependent variables (0, no problem; 1, problem). Independent variables were age, gender, living conditions (0, own home; 1, special accommodation), cohabitation (0, living alone; 1, living with someone), the diagnosis categories, such as mental disorders, circulatory diseases, respiratory diseases, injury and poisoning (0, not having the disease; 1, having the disease), drug consumption (0, one to three drugs; 1, four to six drugs; 2, ≥seven drugs), nutritional status measured by SGA (0, A; 1, B–D) and functional status measured by Katz's ADL index (0, A–C; 1, D, E, O; 2, F, G). Age and gender were included in the final model to control for them being possible confounders. Odds ratios (ORs) with 95% confidence intervals (CIs) were estimated. Gender, living conditions, cohabitation, diagnosis categories, drug consumption, nutritional status and functional status with $P \leq 0.10$ were included as possible predictors in the logistic multiple regression analyses (forward conditional; 29).

P-values less than 0.05 were regarded as statistically significant. The statistical package SPSS 10.0 was used.

Results

Minor statistical differences were found regarding patient characteristics between the different rehabilitation wards. Patients at the H-LRW had a shorter hospital stay than those at the GERW (Table 1). More patients at the ORW were in great or total dependency on help with daily activities compared to patients at the H-LRW and the GERW. No statistical differences in oral health status were found between the three rehabilitation wards, except for problems related to mucous membranes. Patients at the ORW had more problems than patients at the GERW ($P = 0.048$).

The mean age of the total sample was 81.7 years (range 65–98 years), and 73% of the patients were women. Most patients (45%) had diagnoses within the category of 'injury and poisoning' (Table 2). On average, the patients used seven prescribed drugs (range 1–20).

Oral health problems were detected in 71% of the rehabilitation patients on admission. The number of oral health problems varied between one and eight, and 30% of the patients with oral health problems had between four and eight problems. Low saliva flow and problems related to lips (56 and 50%, respectively) were most frequent (Table 3).

Table 3. **Oral health problems in 161 elderly rehabilitation patients**

Category	*n* (%)
Voice	9 (6)
Lips	80 (50)
Mucous membranes	40 (25)
Tongue	59 (37)
Gums*	20 (12)
Teeth/dentures	27 (17)
Saliva	90 (56)
Swallowing	7 (4)

*Missing data in one patient.

Table 4 demonstrates significant associations of categories in ROAG (lips, mucous membranes, tongue, gums, teeth/dentures and saliva) with prevalence of respiratory diseases, living in special accommodation, being at risk for undernourishment (UN), suspected or manifest UN and gender (women). Problems with gums, lips, alterations on the tongue and mucous membranes were all associated with the prevalence of respiratory diseases. The highest OR was found in problems with gums in relation to prevalence of respiratory diseases (OR 8.9; CI 2.8–27.8). In decreased order, alterations on the tongue were associated with the presence of respiratory diseases, UN and special

Table 2. **Characteristics of patients and differences between patients in different rehabilitation wards**

Characteristics	Total ($n = 161$)	Heart-lung ward (H-LRW, $n = 55$)	Orthopaedic ward (ORW, $n = 62$)	General elderly ward (GERW, $n = 44$)	*P*
Age					
Mean (range)	81.7 (65–98)	81.1 (68–98)	83.3 (70–93)	80.3 (65–94)	NS
Length of hospital stay (days)					
Mean (range)	30.8 (4–128)	25.2 (4–78)	30.9 (11–94)	37.8 (8–128)	0.008†
Gender (%)					
Men	27	33	26	23	
Women	73	67	74	77	NS
Reason for admission (ICD-9; %)§					
Mental disorders (290–319)	6	0	0	20	–
Circulatory system (390–459)	16	29	6	14	–
Respiratory system (460–519)	12	16	7	14	–
Injury and poisoning (800–999)	45	22	84	18	–
Other diseases	21	33	3	34	–
Katz ADL index (%)§					
A–C (no or some dependency)	26	33	13	37	
D, E, O	27	33	27	21	0.029*
F, G (much or total dependency)	46	34	60	42	0.041‡
Undernourished (SGA; B–D)	54	51	60	50	NS

Age and length of hospital stay: one-way ANOVA (these variables were categorised, see statistics); gender, undernourished and Katz's ADL index: chi-square test. All tests were corrected with Bonferroni method.
*Statistical significance between H-LRW and ORW.
†Statistical significance between H-LRW and GERW.
‡Statistical significance between ORW and GERW.
§Missing data in one patient at the GERW.

Table 4. **Factors significantly associated with problems in oral health status in 161 elderly rehabilitation patients**

Variable categories	*n*	Lips with problem			Mucous membranes with problem			Tongue with problem			Gums with problem			Teeth/dentures with problem			Saliva with problem		
		n (%)	OR (95% CI)	*P*	*n* (%)	OR (95% CI)	*P*	*n* (%)	OR (95% CI)	*P*	*n* (%)	OR (95% CI)	*P*	*n* (%)	OR (95% CI)	*P*	*n* (%)	OR (95% CI)	*P*
Presence of respiratory diseases																			
Yes	18	15 (83)	5.6 (1.5–21.0)	0.011	8 (44)	3.7 (1.2–10.9)	0.018	12 (67)	5.0 (1.5–16.3)	0.008	8 (44)	8.9 (2.8–27.8)	<0.0005	–	–	–	–	–	–
No*	142	65 (46)	–	–	32 (22)	–	–	47 (33)	–	–	12 (8)	–	–	–	–	–	–	–	–
Special accommodation																			
Yes	38	–	–	–	–	–	–	22 (58)	2.5 (1.1–5.8)	0.038	–	–	–	12 (32)	3.4 (1.3–8.5)	0.010	30 (79)	4.5 (1.7–12.4)	0.003
No	122	–	–	–	–	–	–	37 (30)	–	–	–	–	–	15 (12)	–	–	60 (49)	–	–
Undernourished																			
Yes (SGA B–D)	87	–	–	–	–	–	–	43 (49)	4.4 (2.0–9.6)	<0.0005	–	–	–	–	–	–	56 (64)	2.7 (1.3–5.4)	0.007
No	74	–	–	–	–	–	–	16 (22)	–	–	–	–	–	–	–	–	34 (46)	–	–
Gender																			
Women	117	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	71 (61)	2.5 (1.1–5.5)	0.029
Men	44	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19 (43)	–	–

Factors without influence were advanced age, cohabitation, prevalence of mental disorders, circulatory diseases or injury and poisoning, drug consumption and functional status.
*Missing oral health status data in one patient.

Table 5. **Oral health problems in 87 undernourished elderly rehabilitation patients**

Category	*n* (%)
Voice	6 (7)
Lips	48 (55)
Mucous membranes	26 (30)
Tongue	43 (49)
Gums*	14 (16)
Teeth/dentures	16 (18)
Saliva	56 (64)
Swallowing	7 (8)

*Missing data in one patient.

accommodation. Low saliva flow was associated with the presence of special accommodation, UN and gender (women). Problems with voice and difficulties in swallowing were not associated with any of the independent variables.

Oral health problems in a subsample consisting of 87 UN patients are presented in Table 5. The patients with UN had significantly more alterations on the tongue ($P < 0.0005$), lower saliva flow ($P = 0.026$) and difficulties in swallowing ($P = 0.016$) than the well-nourished patients.

Discussion

In this study, oral health problems were a frequent finding among the elderly rehabilitation patients on admission. The sample was admitted to the wards based on their medical condition. However, only minor differences were found in their oral health status as measured using ROAG between the patient groups.

Although no training in how to use ROAG was given before initiation of this study, a high frequency (71%) of oral health problems was detected. However, in spite of the fact that lectures in oral health were given and that the registered nurse practised at the hospital dentistry fewer patients (17%) were found with problems related to teeth/dentures in this study than that previously reported among geriatric patients at hospital. Plaque or debris on teeth or dentures have been reported in the range of 58–95% (8, 11, 30), and decayed teeth in the range of 61–72% (9,10). The discrepancy in results obtained in this study compared to papers cited above could be explained by differences in diagnosing/assessing oral health problems, and by the fact that previous studies often had been carried out by dental personnel and not by registered nurses. Plaque, debris, decayed teeth and damaged dentures seem to be difficult for nurses to detect. One possible explanation for this could be the lack of training in how to use the ROAG. It is possible that training in how to use the assessment tool could have increased the percentage of patients assessed as having problems with teeth/dentures. This highlights

the need for training and support when a new task is introduced in the nursing care.

Low saliva flow was registered as the most common (56%) oral health problem among the patients. This is in accordance with the report by Pajukoski *et al.* (31) that found 55% of hospitalised patients having a dry mouth. Although the patients in this study had a high intake of drugs, no association was found between low saliva flow and increased number of drugs taken. This differs from results reported by Thorselius *et al.* (32) and Nederfors *et al.* (33). One explanation for this discrepancy could be that when the patients in this study were admitted to the rehabilitation wards, they were likely to receive prescriptions of drugs related to their medical condition. These new drugs had accordingly been used for a limited time period and thereby possibly did not affect the salivary flow yet. However, associations between low salivary flow and being a woman, living in special accommodation and being UN were found in this study. An association between dry mouth and being a woman was reported by Nederfors *et al.* (33), and a reduced saliva flow and poor nutritional status were found by Dormenval *et al.* (34). Saliva flow may interfere with functions, such as chewing, swallowing and talking, thereby affecting the well being of the patient. Assessing the saliva flow is therefore important in the care of the elderly patient. The assessment method included in ROAG (Table 1) is easy to incorporate in nursing care.

Tongue alterations are a common finding among elderly individuals, and have been reported by others in the same range as in this study (37%; 12, 35). In this study, tongue alterations were also associated with being UN. This is not surprising as nutritional insufficiency, lack of niacin and vitamin B_{12} may cause alterations/symptoms on the tongue (36). On the other hand, tongue alterations may result in difficulties in eating and talking, thereby affecting the nutritional status (37). Mattsson *et al.* (38) demonstrated a strong relationship between changes on the tongue, i.e. papillary hypertrophy and glossitis, and decreased general health status.

Problems with voice and difficulties in swallowing were rarely detected in this study. Less than 10% were found in these categories among the UN patients. This is in the same range as Andersson *et al.* (12) found in well-nourished elderly rehabilitation patients mainly admitted for stroke. However, Andersson *et al.* (12) also reported that 24% of UN patients had problems with voice and 42% had difficulties in swallowing. Although 54% of the patients in this study were UN, no such result was found. There is no obvious explanation to the differences in results, but one possible explanation could be the different patient diagnoses at admittance.

In this study, several oral assessment categories were associated with the presence of respiratory diseases. Dental plaque has been proposed to be a risk factor for respiratory diseases (39). Langmore *et al.* (40) reported dependence on oral care and number of decayed teeth as significant predictors of aspiration pneumonia. Terpenning *et al.* (16) suggested decayed teeth, cariogenic bacteria and periodontal pathogens as potential risk factors for aspiration pneunomia. In our study, plaque or decayed teeth were not found to have a significant impact regarding respiratory diseases. The highest OR among the oral health problems associated with respiratory diseases was found for problems related to gums. Oedematous, red and bleeding gums are symptoms of gingivitis caused by periodontal bacteria. *Porphyromonas gingivalis* (Pg) is a pathogen associated with periodontal disease (41). Terpenning *et al.* (16) reported an OR of 4.2 (95% CI 1.6–11.3) between aspiration pneumonia and Pg. This supports the suggestion that periopathogens may be a risk factor for aspiration pneumonia. A proper oral care is necessary to avoid gingivitis and other oral health problems among compromised elderly. Oral health assessments and initiation of adequate oral care procedures are important already on admission of the patients to the hospital ward. The oral health status should then continuously be followed using ROAG.

Elderly living in special accommodations are reported to have poor oral health (42). This was also confirmed in our study. The majority of the residents living in special accommodation require some or complete assistance with oral care (43). A high proportion of the residents may also be unwilling to receive help with oral care (44). The frequent finding of oral health problems, and associations between oral health problems and prevalence of respiratory diseases, living in special accommodation, being UN and being a woman establish the importance of systematic oral health assessments among elderly rehabilitation patients. In the future, attitudes to prevent oral health problems may change as the coming elderly individuals most likely will have higher expectations regarding quality in dental care (45). In this respect, implementation of ROAG in order to recognise oral health problems early in community elderly care may also be a valuable tool in this care setting. To ensure a high reliability of the oral assessments, the nurses should attend lessons in oral health matters and be trained in how to use ROAG. Continuous support from a dental hygienist, as well as a pictorial manual included in ROAG, may further improve the reliability.

Conclusions

Problems with oral health status were a common finding among rehabilitation patients. Oral health problems were significantly associated with presence of respiratory diseases (problems with

gums, lips, alterations on the tongue and mucous membranes); living in special accommodation (low saliva flow, problems with teeth/dentures and alterations on the tongue); being UN (alterations on the tongue and low saliva flow) and being a woman (low saliva flow). These findings indicate the importance of standardised oral health assessments in order to detect oral health problems that otherwise could be hidden when the patients are admitted to the hospital ward.

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