

Association of Oral Health and Systemic Diseases in the Elderly

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ABSTRACT

Introduction: Oral health may have an impact on general health with clinical implications.

Objective: To assess association of oral health with systemic diseases in the elderly.

Materials and methods: A cross-sectional study was conducted in 232 elderly subjects (above 50 years) who visited the geriatric medicine OPD at Government Medical College and Hospital, Chandigarh. Oral examination was conducted using the WHO Oral Assessment Form (1997). Written informed consent was taken. Patients were grouped according to their systemic health into six groups: Healthy elderly (group 1), hypertension and coronary artery disease (group 2), chronic obstructive pulmonary disease (group 3), diabetes (group 4), diabetes and hypertension (group 5) and hypertension (group 6).

Results: Average DMFT for coronal caries in the six groups was 23.8, 21.24, 22.15, 22.58, 17.83, 22.22 respectively and root caries 22.04, 18.05, 19.46, 14.90, 14.75, 18.62. Periodontal status was assessed by recording the CPI score and attachment loss. Chi-square test was applied, a significantly ($p < 0.05$) higher CPI score was recorded for groups 2, 3, 6 compared to group 1 while attachment loss was significantly ($p < 0.05$) higher in diabetics (group 4) compared to group 1. Applying the Z-test for proportions a significantly ($p < 0.05$) higher number of group 1 edentulous subjects were using upper/lower complete dentures as compared to groups 4 and 5.

Conclusion: Findings of this study indicate an inverse relationship of periodontal health with systemic diseases in the selected sample but further research is needed with larger sample to authenticate the results.

Keywords: Systemic disease, Dental caries, Edentulousness, Periodontal disease.

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INTRODUCTION

A gradual transition in the population has occurred in India, with reduction in percentage of the child population (0-14 years) and increase in the percentage of the elderly (+60 years). Percentage of population aged 60 and above of the total population in India in the year 2010 was 7.5%¹ and the projected increase is 10.7% by 2021.² This has been attributed to improved health care facilities, sanitation, environmental and public health reforms, coupled with better hygiene and living conditions.

The Government Medical College and Hospital is located at Chandigarh which is a joint capital of the states of Punjab and Haryana. A large number of elderly patients visit the hospital daily. Oral health has an impact on quality of life, as it affects esthetics, chewing ability, speech, comfort and emotional well being. Many of these patients have multiple coexisting medical problems, consume multiple medications for chronic systemic conditions like cardiac disease, respiratory problems, hypertension, psychiatric illness which may cause xerostomia, that increases the risk for dental caries as well as periodontal disease.³ Yet another factor is the influence of disability due to systemic diseases that affects the ability to carry out oral hygiene practices and adversely influences the oral microbial flora.

The association of oral infections with systemic diseases is receiving increased interest in the research world. The link between oral microbial infections and systemic disease is not a new concept. Evidence from ancient Egyptian medicine suggests that general health of the body could be improved subsequent to tooth extractions.⁴ Assyrians in the 7th century BC proposed that oral health affects the rest of the body.⁵ A similar hypothesis was given by Hippocrates (460-377BC). In 1778 John Hunter a surgeon from England wrote that diseases of the teeth are likely to produce diseases in the neighboring parts, may be with serious consequences. This association was not given much attention till 1800. In 1818 Benjamin Rush a doctor from Pennsylvania recognized the focal infection theory, according to which oral infections caused inflammation in distant sites of the human system. In 1879, WD Miller from the University of Pennsylvania Dental School travelled to Berlin and at Koch's Institute looked into the relationship between oral bacteria and systemic diseases. In a series of articles published by Miller in 1891 he stated that pathogenic germs from the oral cavity produced disorders of the body.⁴

Studies have shown the oral-systemic connection. People with certain cardiac conditions, coagulation abnormalities and those with artificial joints are thought to be vulnerable to some of the microbes that live in the oral cavity.⁶⁻¹¹ Periodontal disease affects the status of diabetes.^{12,13} Most of the evidence is based from epidemiological studies. The present study was carried out in the elderly to assess if there is any association between oral health and systemic diseases.

MATERIALS AND METHODS

The study was conducted on elderly patients visiting the geriatric medicine OPD at Government Medical College and Hospital, Chandigarh. The OPD patients were diverse in terms of locality, age, education, though more or less of similar socioeconomic status. Locality wise they came from different states of north and central India. The age of these subjects ranged from 50 to +90 years.

Selection of Subjects

A random sample of 232 subjects was drawn from patients visiting the geriatric medicine OPD with systemic health problems during summer vacations, i.e. from mid May 2008 to mid July 2008 (within a period of 60 days). A cross-sectional population-based survey was carried out. All subjects who participated in the study were using nonfluoridated dentifrice and there was no water fluoridation in the areas from where these patients came.

Oral Examination

Oral examination was conducted using the WHO Oral Health Assessment Form (1997)¹⁴ for recording dental caries, periodontal disease and edentulousness. Income and medical history were recorded. All participants were on follow-up treatment in the OPD. Written informed consent was taken from all the participants. The geriatric medicine OPD is run 6 days a week by the Department of General Medicine.

One examiner (MT) did the oral examination. For the purpose of recording plane mouth mirror and CPI probe was used. Coronal and root caries were recorded on all teeth including third molars. Periodontal status was recorded on ten index teeth 11, 16, 17, 26, 27, 31, 36, 37, 46, 47.

Statistical Analysis

The subjects examined were divided into various groups depending on the systemic diseases. Dental caries (coronal and root), periodontal status (CPI score and attachment loss) and edentulousness were compared in the various groups. Summary statistics was calculated of DMFT for coronal and root caries. The association of CPI score and attachment loss for various groups was computed using Chi-square test taking healthy elderly as basis for comparison. Comparison of upper/lower arches for prosthetic status and prosthetic need was done using Z test for proportions keeping healthy elderly as control group. The IBM SPSS statistics package version 20 was used for the analysis.

RESULTS

A total of 232 elderly subjects were examined and their medical history was recorded. The subjects were divided into six groups based on systemic diseases, they were having. Group I comprised of healthy elderly subjects (HE); group 2 had subjects with hypertension and coronary artery disease (HT + CAD); group 3 subjects had chronic obstructive pulmonary disease (COPD); group 4 subjects had diabetes; group 5 were those subjects with diabetes alongwith hypertension (D + HT) and group 6 were subjects with hypertension (HT) as shown in Table 1.

Average DMFT for coronal caries in the six groups was 23.8 (group 1), 21.24 (group 2), 22.15 (group 3), 22.58 (group 4), 17.83 (group 5), 22.22 (group 6) as shown in Table 1. Corresponding DMFT for root caries was 22.04, 18.05, 19.46, 14.90, 14.75 and 18.62, as shown in Table 2.

Periodontal status was assessed by recording CPI score and attachment loss. CPI score recorded gingival bleeding,

Table 1: Summary of statistics for coronal caries in the various groups

Groups	Number of subjects		Mean DMFT
	N = 232	%	
1 Healthy elderly	25	10.77	23.8
2 Hypertension and coronary artery disease	37	15.94	21.24
3 Chronic obstructive pulmonary disease	26	11.20	22.15
4 Diabetes	31	13.36	22.58
5 Diabetes and hypertension	36	15.51	17.83
6 Hypertension	77	33.18	22.22

Table 2: Summary of statistics for root caries in the various groups

Groups	Number of subjects		Mean DMFT
	N = 232	%	
1 Healthy elderly	25	10.77	22.04
2 Hypertension and coronary artery disease	37	15.94	18.05
3 Chronic obstructive pulmonary disease	26	11.20	19.46
4 Diabetes	31	13.36	14.90
5 Diabetes and hypertension	36	15.51	14.75
6 Hypertension	77	33.18	18.62

calculus and periodontal pockets. Recordings were done on 10 index teeth. Comparison of code 1, 2, 3, 4 of healthy elderly was done with groups having systemic disease (Table 3). There were significantly ($p < 0.05$) higher CPI scores in subjects with hypertension and coronary artery disease (group 2), chronic obstructive pulmonary disease (group 3) and hypertension (group 6) compared to the healthy elderly subjects. No statistically significant difference was seen between the healthy elderly (group 1) and groups 4, 5. Attachment loss recorded the destruction of periodontal attachment. Attachment loss was significantly ($p < 0.05$) higher in diabetics (group 4) compared to healthy elderly (group 1) as shown in Table 4.

Prosthetic status was recorded, code 0 for no prosthesis, code 1 for bridge, code 2 for more than one bridge, code 3 for partial denture, code 4 for bridge and partial denture and code 5 for full removable denture. For all the groups, code 1, 2, 4 recorded a score of zero. Z test for proportions was applied to study the prosthetic status for maxillary and mandibular arches, as shown in Table 5. Comparison of the elderly with systemic diseases (groups 2, 3, 4, 5, 6) with

healthy elderly (group 1) showed a higher percentage of elderly with systemic disease were not using any prostheses (Table 5). There was no statistically significant difference between the groups in use of partial dentures (Table 5). Forty percent of healthy elderly were using full removable upper/lower dentures, 21.6% in group 2, 30.7% in group 3, 16.1% in group 4, 16.6% in group 5 and 27.2 in group 6. In patient with diabetes (group 4) and diabetes with hypertension (group 5) the use of upper and lower prostheses was less compared to the healthy elderly. The percentage of edentulous subjects, who were edentulous in the six groups was 44% (group 1), 35.13% (group 2), 31.03% (group 3), 22.58% (group 4), 19.44% (group 5) and 40.25% (group 6) (Table 7). Least number of subjects in group 1 needed upper/lower prosthesis (Table 6). Though the percentage of edentulous subjects was highest in the healthy elderly, use of dentures was also more prevalent.

DISCUSSION

Average DMFT ranged from 17.83 to 23.8 for coronal caries, 14.75 to 22.04 for root caries and edentulousness

Table 3: Comparison of periodontal status—CPI scores for the five groups with health elderly

Groups	No. of subjects (n = 232)	Code 0 Healthy	Code 1 Bleeding	Code 2 Calculus	Code 3 Pocket 4-5 mm	Code 4 Pocket 6 mm	Chi-square (χ^2)	df	p-value
1	Healthy elderly (n = 25)	4	12	28	17	3	—	—	—
2	Hypertension + CAD (n = 37)	6	21	64	22	0	7.553	3	0.049*
3	COPD (n = 26)	7	9	21	37	0	11.485	3	0.009*
4	Diabetes (n = 31)	3	13	53	49	8	4.374	3	0.224
5	Diabetes + HT (n = 36)	26	13	63	30	3	3.155	3	0.368
6	HT (n = 77)	16	8	135	62	10	19.167	3	0.0001*

*Significant (all associations with health elderly); Code 0 not included for association as it did not represent disease

Table 4: Comparison of periodontal status: Attachment loss for the five groups with the health elderly

Groups	No. of subjects n = 232	Code 0 0-3 mm	Code 1 4-5 mm	Code 2 6-8 mm	Code 3 9-11 mm	Code 4 12 mm	Chi-square (χ^2)	df	p-value
1	Healthy elderly (n = 25)	14	29	17	4	0	—	—	—
2	HT + CAD (n = 37)	31	44	35	5	1	1.447	3	0.47
3	COPD (n = 26)	22	23	25	2	0	2.883	2	0.237
4	Diabetes (n = 31)	20	47	57	2	0	7.403	2	0.025*
5	Diabetes + HT (n = 36)	58	45	28	5	1	0.779	3	0.86
6	HT (n = 77)	61	99	61	10	1	0.606	3	0.96

*Significant (all associations with health elderly); Code 0 not included for association as it did not represent disease

Table 5: Prosthetic status for the maxillary and mandibular arches in the various groups

Groups	Code 0 No prosthesis		Upper (U)		Lower (L)		Code 3 Partial denture		Upper (U)		Lower (L)		
	U	L	Z test	p-value	Z test	p-value	U	L	Z-test	p-value	Z-test	p-value	
1	Healthy elderly (n = 25)	13	13	—	—	—	—	2	2	—	—	—	—
2	HT + CAD (n = 37)	27	27	-1.69	0.090	-1.69	0.090	2	3	0.39	0.693	-0.02	0.988
3	COPD (n = 26)	17	17	-0.98	0.328	-0.98	0.328	1	1	0.63	0.530	-0.63	0.530
4	Diabetes (n = 31)	23	24	-1.75	0.081	-2.03	0.042*	2	2	0.22	0.825	0.22	0.825
5	Diabetes + HT (n = 36)	28	30	-2.12	0.034*	-2.66	0.008*	2	1	0.37	0.713	0.86	0.390
6	HT (n = 77)	54	53	-1.61	0.108	-1.49	0.136	1	3	1.20	0.23	0.70	0.483

*Significant using Z test for proportions. All comparisons made with healthy elderly (group 1)

Table 6: Prosthetic need for the maxillary and mandibular arches in the six groups

Groups	Code 0 No prosthesis needed		Upper (U)		Lower (L)		Code 2 Need for multiunit prosthesis		Upper (U)		Lower (L)	
	U	L	Z-test	p-value	Z-test	p-value	U	L	Z-test	p-value	Z-test	p-value
1 Healthy elderly (n = 25)	6	5	—	—	—	—	6	8	—	—	—	—
2 HT + CAD (n = 37)	10	10	-0.27	0.788	-0.65	0.516	14	16	-1.18	0.236	-0.91	0.364
3 COPD (n = 26)	9	5	-0.84	0.401	0.07	0.945	5	9	0.41	0.679	-0.20	0.843
4 Diabetes (n = 31)	9	9	-0.43	0.670	-0.79	0.429	13	15	-1.46	0.145	-1.27	0.206
5 Diabetes + HT (n = 36)	14	11	-1.26	0.207	-0.95	0.341	7	13	0.42	0.673	0.33	0.738
6 HT (n = 77)	21	21	-0.33	0.742	-0.77	0.443	23	25	-0.59	0.558	-0.04	0.965

All associations were nonsignificant ($p > 0.05$). All comparisons made with healthy elderly (group 1)

Table 7: Edentulousness in the six groups

Groups	No. of subjects		No. edentulous	Percentage of elderly edentulous
	n = 232	%	N	
1 Healthy elderly	25	10.77	11	44
2 HT + CAD	37	15.94	13	35.13
3 COPD	26	11.20	9	31.03
4 Diabetes	31	13.36	7	22.58
5 Diabetes + HT	36	15.51	7	19.44
6 HT	77	33.18	31	40.25

from 19 to 44%. Both edentulousness and dental caries was high in this population regardless of systemic health. A study from south India reported a DMF index of 13.5.¹⁵ The high DMFT in this population regardless of systemic health could possibly be due to lack of awareness and importance of oral health and the ability to access oral health services for restorative care. In this study the prevalence of coronal caries was found to be more than root caries. The findings are similar to a study by Thompson but contrasting to a study done by Shah and Sundaram where root caries comprised two-third of the lesions.³

CPI score was statistically significantly ($p < 0.05$) higher in patients with COPD, hypertension and those having hypertension and coronary artery disease compared to the healthy elderly (Table 3) indicating that subjects who were healthy had better periodontal health compared to those who were medically compromised. In subjects with COPD use of inhalers causes dryness of the oral cavity, which alters the oral ecology making the subjects more prone to disease.¹⁶

Attachment loss was higher in the elderly with systemic diseases compared to the healthy elderly though this difference was not statistically significant except for subjects with diabetes (group 4) who had significantly $p < 0.05$ higher attachment loss. Evidence of a bidirectional relationship between diabetes mellitus and periodontal disease comes from studies conducted worldwide though in different settings. Patients with periodontal disease have a 1.5- to 2-fold greater risk of having fatal CVD compared to patients without periodontal disease.^{17,18} The concentration of

glycated hemoglobin (a measure of diabetic control) was found to be elevated in people with type 2 diabetes and severe periodontal disease, in a study by Shlossman et al.¹⁷

Use of dentures (prosthesis) was higher in the healthy elderly compared to those with systemic diseases which could possibly be due to the fact that systemic health was a priority over oral health. While those who have good health, sought dental services and were wearing prosthesis. The healthy elderly comprised of those elderly who came for a routine checkup and investigations. It is possible that they had undiagnosed systemic disease which they may not have been aware of.

There are certain issues specific to the ageing population. The social support of these individuals undergoes a change like economic constraints, retirement, living alone, problem of transportation and ability to access health services. With ageing physiological decline occurs, there are coexisting chronic diseases, e.g. arthritis, hypertension, cardiac diseases, respiratory illness, etc. and intake of multiple medications which may cause adverse drug reactions (ADRs) and xerostomia. All these have an impact on oral health and utilization of dental services. Oral cavity of the elderly has been exposed to challenges during younger years. Exposure of dentine occurs with age, along with surface diversity because of metal, ceramic and composite restorations thereby increasing the surfaces available for bacterial adhesion. There is a specific preference of oral microbes to colonize certain surfaces in the oral cavity. e.g.: *S. mutans* for enamel, *S. salivarius* for oral mucosal

surfaces.¹⁹ In the ageing population because of surface diversity, altered ecology and xerostomia the oral cavity is more prone to disease.

Though it is difficult to obtain a cause and effect between oral infections and systemic diseases because of several confounding factors and oral infections are one of the many influences. The findings of this investigation are suggestive that healthy elderly subjects had better periodontal health and sought dental services more compared to those with systemic diseases. Association of periodontal health with diabetes and hypertension (group 2), chronic obstructive pulmonary disease (group 3) and diabetes (group 4) is significant. The elderly in the present study comprised of a heterogeneous population with wide variation in age, systemic health and educational status. As the sample size comprised of only 232 subjects it restricts the scope and ability to generalize the survey and further work in this direction is needed.

Occurrence of dental caries and edentulousness was high in the elderly population studied at Chandigarh indicating a need for early planning of oral health services for the ageing population of the city and those visiting the hospital from the periphery.

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