ECRONICON OPEN ACCESS

EC DENTAL SCIENCE
Research Article

Comparison of Extent and Severity of Periodontal Disease and Salivary Characteristics in 45 - 59yrs and 60 - 85yrs Old Adults-A Hospital-Based Cross-Sectional Study

Jisha Putheeran[1], Rosamma Joseph Vadakkekuttical[2]* and Harikumar Kanakkath[3]

[1]Senior Resident, Department of Periodontics, Government Dental College, Affiliated to Kerala University of Health Sciences, Kozhikode, Kerala, India

[2]Professor and Head, Department of Periodontics, Government Dental College, Affiliated to Kerala University of Health Sciences, Kozhikode, Kerala, India

[3]Additional Professor, Department of Periodontics, Government Dental College, Affiliated to Kerala University of Health Sciences, Kozhikode, Kerala, India

***Corresponding Author:** Rosamma Joseph Vadakkekuttical, Professor and Head, Department of Periodontics, Government Dental College, Affiliated to Kerala University of Health Sciences, Kozhikode, Kerala, India.

Received: June 11, 2022; **Published:** December 07, 2022

Abstract

Background: Periodontal health is often neglected in elders and this has become an important public health issue. The data regarding the burden of periodontal disease is mandatory for implementing an effective and specific periodontal health program in elders.

Objective: This study conducted to assess and compare the extent and severity of periodontal disease and salivary characteristics in 45 - 59yrs old and 60 - 85yrs old adults.

Methods: This cross-sectional study comprised of 400 elders grouped in to 45 - 59yrs (n = 200) and 60 - 85yrs (n = 200) old]. All subjects were assessed for periodontal parameters [oral hygiene index simplified, modified gingival index, probing pocket depth (PPD), clinical attachment loss (CAL) and gingival recession], systemic parameters [fasting blood sugar and fasting lipid profile] and salivary characteristics [salivary pH and buffering capacity].

Results: Extent and severity of periodontitis were higher in 60 - 85yrs old group as compared to 45 - 59yrs old group. Mean clinical attachment loss and gingival recession were higher in 60 - 85yrs old group (4.57 ± 1.17 and 0.77 ± 0.94 respectively) as compared to the 45 - 59yrs old group, whereas the mean probing pocket depth was higher in the 45 - 59yrs old group (3.96 ± 0.80) as compared to the 60 - 85yrs group. Salivary pH and buffering capacity were significantly low in 60 - 85yrs old group. A statistically significant association found between FBS ≥ 100 and periodontitis [(p = 0.035) and (odds ratio 2.02)]. A weak negative correlation had been found between CAL and Salivary pH and CAL and Salivary buffering capacity among study subjects.

Conclusion: The extent and severity of the periodontal disease are higher in 60 - 85yrs old group as compared to the 45 - 59yrs old group. Salivary pH was more acidic and buffering capacity was low in 60 - 85yrs old group.

Keywords: *Aging; Periodontitis; Clinical Attachment Loss; Salivary Ph; Salivary Buffering Capacity; Full Lipid Profile*

Abbreviations

PPD: Probing Pocket Depth; CAL: Clinical Attachment Loss; FBS: Fasting Blood Sugar; FLP: Fasting Lipid Profile; TC: Total Cholesterol; TG: Triglycerides; HDL: High Density Lipoprotein; LDL: Low Density Lipoprotein; VLDL: Very Low Density Lipoprotein; pH: Potential of Hydrogen; OR: Odds Ratio; CI: Confidence Interval

Introduction

Periodontitis is an immunoinflammatory disease affecting the supporting tissues of the teeth caused by specific gram-negative micro-organisms, their by-products and the host-tissue response. This results in progressive destruction of the supporting tissues of the teeth. Besides microbial etiology, several other risk factors are contributing to periodontal disease. Age is considered one of the risk factors that influence the occurrence of periodontal disease. The prevalence and severity of periodontal disease increase with age [1-3]. Chronic periodontitis develops as a slowly progressing disease and it becomes clinically evident in the middle of thirties and continue throughout life [1,2]. similarly systemic disease also begins in the mid thirties. From the literature, it is evident that a bidirectional relationship exists between periodontitis and systemic disease such as diabetes mellitus [4-6]. Dyslipidemia [7,8] etc. inflammation plays a key role in the pathogenesis of systemic diseases and periodontitis. The presence of systemic diseases may modify the host response to plaque accumulation and the disease progression may become more aggressive [9]. The proportion of older people continues to increase worldwide, especially in developing countries. Dental health is often neglected in older persons and dental diseases associated with aging are complex and adversely affecting the quality of life [10]. Poor oral health among old age is an important public health issue and a growing burden for countries worldwide [11]. Periodontal disease associated with elders is severe and the increasing severity may be because of the untreated cumulative effect of the disease process over the period. Moreover, age-associated structural and functional change of periodontal tissues along with the degeneration of the salivary glands that leads to changes in the quantity and quality of saliva also contributed to increased severity of periodontal disease in elders. The knowledge of the oral and periodontal disease among elders will help in the formulation of preventive and treatment strategies that will improve the quality of life. Implementing an effective and specific oral health program in elders, data regarding the burden of oral and periodontal disease in terms of proportion of periodontal disease, extent and severity of the periodontal disease is mandatory. Many epidemiologic studies have been carried out to estimate the periodontal disease burden at different regions and different age strata [1,9,12,13]. To the best of our knowledge, no comparative studies are available on the extent and severity of periodontal diseases and salivary characteristics in elderly.

Aim of the Study

This study was aimed to assess and compare the extent and severity of periodontal disease and salivary characteristics (pH and buffering capacity) in 45 - 59yrs and 60 - 85yrs old adults. The association between systemic disease/conditions like Diabetes and dyslipidemia and periodontal disease were also evaluated.

Materials and Methods

This Cross-Sectional study was conducted in the Department of Periodontics, Dental College Kozhikode. The sample size was calculated based on a previous study [2]. Study subjects with 45 - 59 yrs (group 1) and 60 - 85yrs (group 2) were consecutively selected from the outpatient department of Periodontics (Figure 1). A sample of 200 subjects each was included in group 1 and group 2, thus making the total sample size 400 subjects. Systemically debilitated patients, patients who received periodontal therapy within the past year were excluded. The study was approved by the Institutional Ethics Committee (IEC no: 103/2017/..). Informed consent was obtained from all the study subjects. The periodontal examinations were conducted by a single calibrated examiner (JP) using a standard mouth mirror and William's graduated periodontal probe. The periodontal status was measured by Probing Pocket Depth (PPD), Gingival Recession (GR) and Clinical Attachment Level (CAL) in millimeters at four sites on each tooth. The periodontal status was then recorded as no/mild periodontitis, moderate periodontitis and severe periodontitis based on the criteria proposed by the CDC Working Group for use in

population-based surveillance of periodontitis (CDC 2012 update), Modified gingival index [15]. Oral Hygiene Index-simplified (OHI-S index) and Decayed -Missing -Filled Teeth (DMFT) index were also assessed [14-16]. Biochemical parameters including Fasting blood sugar (FBS), Low-density Lipoprotein (LDL), High-density lipoprotein (HDL), Very low-density lipoprotein (VLDL), Total cholesterol (TC) and Triglycerides (TG) were assessed using a fully automatic biochemistry analyzer EM-360 (ERBA). Salivary pH and buffering capacity were also determined by using whole unstimulated saliva. Salivary pH was measured electrometrically using Cyberscan pH2100 and buffering capacity by Ericsson's method [17].

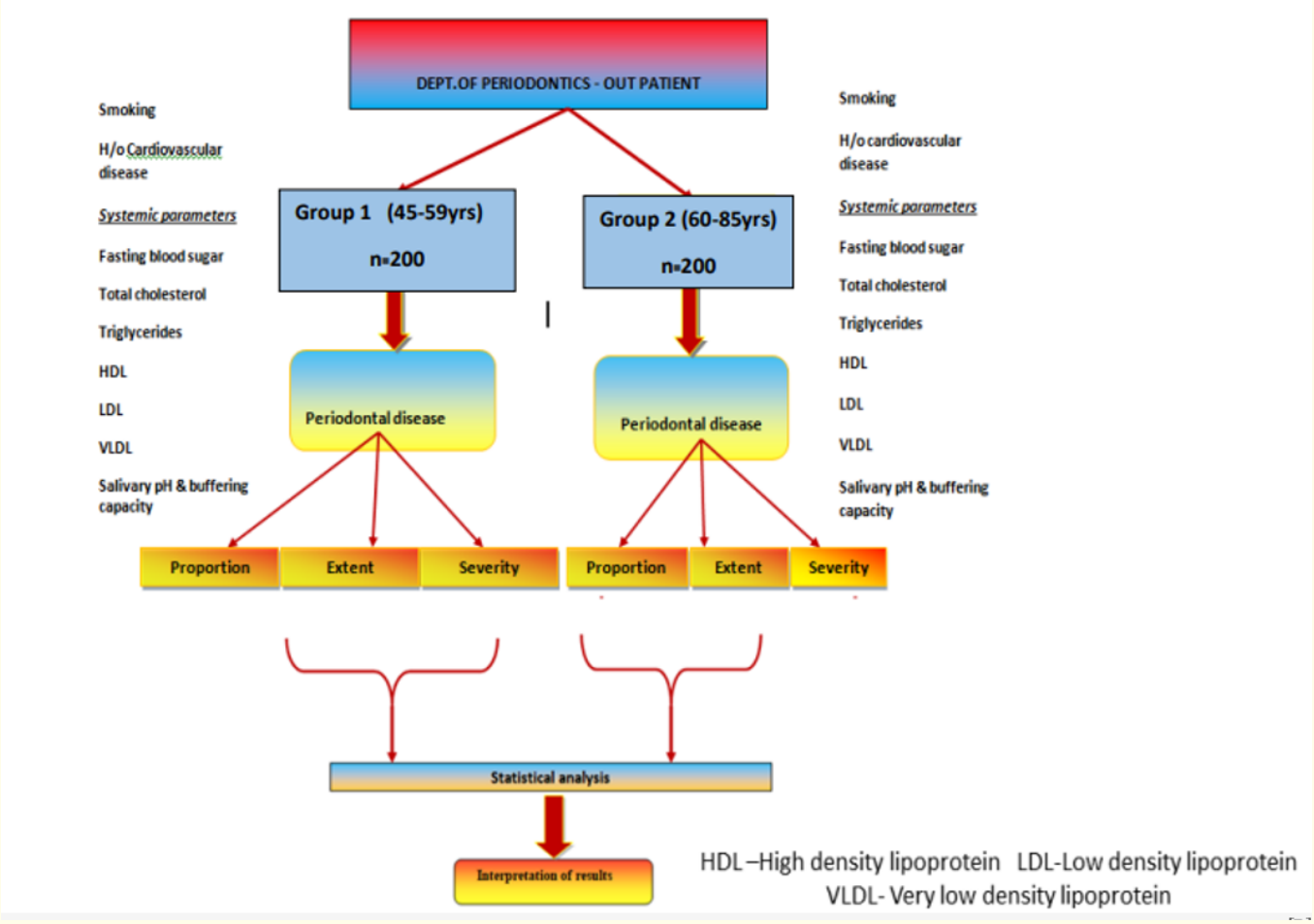

Figure 1: *Study design flow chart.*

Statistical analysis

Mean (± standard deviation) was calculated for quantitative variables and frequency was calculated for qualitative variables. Independent t-test and chi-square tests were used to compare the quantitative and qualitative variables between the groups respectively. Correlation of CAL with age, FBS, salivary pH and buffering capacity were done by Pearson correlation test. Data were analyzed by using SPSS Version18. A was set at 5%.

Result

In this study, 200 group 1 (45 - 59yrs old adults) and 200 group 2 (60 - 85yrs old) adults were examined. The mean age of group 1 and group 2 was 50.46 ± 4.0 and 64.57 ± 4.6 respectively. There were 70 (35%) males and 112 (56%) females in group 1 and 130 (65.0%) males and 88 (44.0%) females in group 2 (Table 1). Oral hygiene habits did not differ between groups and most of the study subjects were brushed once daily with toothpaste and toothbrush for tooth cleaning (Table 2). There was a significant difference in the oral hygiene status, modified gingival index [15] and DMFT between the group 1 and group 2 subjects (Table 3).

Sociodemographic characteristics		Group 1 (45 - 59yrs) (n = 200)	Group 2 (60 - 85yrs) (n = 200)	P value
Age (mean ± SD)		50.46 ± 4.0	64.57 ± 4.6	0.001
Gender	Male	70 (35.0%)	112 (56.0%)	0.001
	Female	130 (65.0%)	88 (44.0%)	
Education	Illiterate	4 (2.0%)	11 (5.5%)	0.03
	Primary school	7 (3.5%)	16 (8.0%)	
	Middle school	56 (28.0%)	70 (35.0%)	
	High school	112 (56.0%)	82 (41.0%)	
	Diploma and above	21 (10.5%)	21 (10.5%)	
Socioeconomic status	BPL	159 (79.5%)	152 (76.0%)	0.57
	APL	41 (20.5%)	48 (24.0%)	

Table 1: *Distribution of sociodemographic characteristics in group 1 and group 2.*

*SD: Standard Deviation; P: Probability Value *P<0.05 significant; N: Sample Size; APL: Above Poverty Line; BPL: Below Poverty Line.*

Oral hygiene practices		Group 1 (45 - 59yrs) (n = 200) Frequency (%)	Group 2 (60 - 85yrs) (n = 200) Frequency (%)	p-value
Method of teeth cleaning	Finger	1 (0.5)	3 (1.5)	0.31
	Brush	199 (99.5)	197 (98.5)	
	Others	0 (0)	0 (0)	
Material used for teeth cleaning	Toothpaste	194 (97.0)	188 (94.0)	0.14
	Toothpowder	6 (3.0)	12 (6.0)	
	Others	0 (0)	0 (0)	
Frequency of teeth cleaning	Once	131 (65.5)	149 (74.5)	0.10
	Twice	68 (34.0)	51 (25.5)	
	After every meal	1 (0.5)	0 (0)	

Table 2: *Comparison of oral hygiene practices in group 1 and group 2 subjects.*

P: Probability Value, P < 0.05 significant; n: Sample Size.

Variables	Group 1 (45 - 59yrs) (Mean ± SD)	Group 2 (60 - 85yrs) (Mean ± SD)	P-value	Mean Difference (95% CI)
OHI-S	5.11 ± 0.74	5.29 ± 0.77	0.02*	-0.17 (-0.32 to 0.02)
Modified gingival index	2.61 ± 0.42	2.70 ± 0.9	0.04*	-0.09 (-0.18 to 0.002)
DMFT	5.08 ± 3.83	6.05 ± 3.77	0.01*	-0.97 (-1.71 to -0.22)

Table 3: *Comparison of oral hygiene status (OHI-S), modified gingival index and DMFT in group 1 and group 2.*
*OHI-S: Simplified Oral Hygiene Index; DMFT: Decayed Missing Filled Teeth; SD: Standard Deviation; CI: Confidence Interval; P: Probability Value; *P < 0.05 Significant.*

A statistically significant difference was observed in mean PPD (p 0.04), GR (p > 0.01) and CAL (p 0.03). The mean PPD in group 1 (3.96 ± 0.80) was higher as compared to group 2 (3.79 ± 0.79) whereas the mean CAL and GR were higher in the group 2 (4.57 ± 1.17 and 0.77 ± 0.94 respectively) as compared to the group 1 (4.35 ± 0.94 and 0.40 ± 0.33 respectively) (Table 4).

Variables	Group 1 (45 - 59yrs) (% of site) (Mean ± SD)	Group 2 (60 - 85yrs) (% of site) (Mean ± SD)	p value	Mean Difference 95%CI)
PPD	3.96 ± 0.80	3.79 ± 0.79	0.04*	0.16 (0.005 to 0.31)
Gingival recession	0.40 ± 0.33	0.77 ± 0.94	0.01*	0.37 (-0.51 to -0.23)
CAL	4.35 ± 0.94	4.57 ± 1.17	0.03*	0.22 (-0.43 to -0.01)

Table 4: *Comparison of probing pocket depth (PPD), Gingival recession and clinical attachment loss (CAL)among patients in group 1 and group 2.*
*PPD: Probing Pocket Depth; CAL: Clinical Attachment Loss; CI: Confidence Interval; SD: Standard Deviation; P: Probability Value *P<0.05 Significant.*

The proportion of periodontitis in group 1 was 89% and in the group 2 was 89.5% (p = 0.7) (Table 5). Severe periodontitis was significantly higher in the group 2 as compared to the group 1 (Table 6). The mean percentage of sites with CAL ≥ 6 mm was significantly higher in group 2 (28.5 ± 25.8) as compared to the group 1 (23.4 ± 18.9) (Table 7).

Periodontitis Frequency (%)	Group 1 (45 - 59yrs)	Group 2 (60 - 85yrs)	p-value
Present	178 (89)	179 (89.5)	0.872
Absent	22 (11.0)	21 (10.5)	
P - Probability value, P < 0.05 significant			

Table 5: *Proportion of periodontitis in group 1 and group 2 subjects.*

Category	Group 1 (45 - 59yrs) Frequency (%)	Group 2 (60 - 85yrs) Frequency (%)	P Value
Mild/No Periodontitis	22 (11.0%)	24 (12.0%)	0.03*
Moderate Periodontitis	128 (64.0%)	104 (52.0%)	
Severe Periodontitis	50 (25.0%)	72 (36.0%)	

Table 6: *Proportion of periodontal disease severity among patients in group 1 and group 2 subjects.*
*P: Probability value *P < 0.05 significant.*

Variables (% of the site)	Group 1 (45 - 59yrs) (Mean ± SD)	Group 2 (60 - 85yrs) (Mean ± SD)	p-value	Mean Difference (95%CI)
CAL ≤ 3 mm	32.1 ± 28.2	29.8 ± 30.0	0.42	2.75 (3.39 - 8.08)
CAL 4 to 5 mm	44.3 ± 19.8	41.4 ± 21.7	0.12	2.34 (1.17 - 7.02)
CAL ≥ 6 mm	23.4 ± 18.9	28.5 ± 25.8	0.02*	-5.10 (-9.56 - 0.65)

Table 7: *Percentage of sites with CAL ≤ 3 mm, 4 to 5 mm and ≥ 6 mm among patients in the group1 and group2. CAL: Clinical Attachment Loss; SD: Standard Deviation; CI: Confidence Interval; P: Probability Value *P < 0.05 significant.*

Mean FBS and LDL were higher in group 2 as compared to group 1 and the mean HDL in group 1 was higher as compared to group 2 (Table 8). The salivary pH and buffering capacity were significantly lower in the group 2 as compared to the group 1 (Table 8).

Parameters	Group 1 (45 - 59yrs) (Mean ± SD)	Group 2 (60 - 85yrs) (Mean ± SD)	p-value
FBS-mg%	111.3 ± 35.07	121.3 ± 36.5	0.001*
TC-mg%	213.8 ± 48.8	216.04 ± 51.17	0.65
TG-mg%	126.4 ± 58.6	121.04 ± 47.7	0.30
HDL-mg%	54.56 ± 14.5	47.8 ± 13.07	0.001*
LDL-mg%	135.49 ± 40.23	143.8 ± 47.2	0.001*
VLDL-mg%	25.2 ± 11.4	24.14 ± 9.5	0.31
Salivary pH	6.70 ± 0.37	6.50 ± 0.42	0.04*
Salivary buffering capacity	4.83 ± 0.73	4.53 ± 0.72	0.01*

Table 8: *Comparison of biochemical parameters and salivary characteristics in the group1 and group2. P: Probability value *P < 0.05 significant; SD: Standard Deviation; FBS: Fasting Blood Sugar; TC: Total Cholesterol; TG: Triglycerides; HDL: High-Density Lipoprotein; LDL: Low-Density Lipoprotein; VLDL: Very Low-Density Lipoprotein; pH: Power of Hydrogen Ions.*

Association of risk factors such as smoking, FBS, FLP on periodontitis was assessed by combining both group 1 and group 2 subjects (Table 9). There was no statistically significant association between smoking and periodontitis in this study. This may be due to the presence of more non-smokers, among 400 study subjects, 375 subjects were non-smokers. A statistically significant association found between FBS ≥ 100 and periodontitis (p = 0.035), OR 2.02 (95% CI 1.04 to 3.5). From this study, it was found that diabetic patients had 2.02 times increased risk of developing moderate-severe periodontitis than non-diabetic patients. TC > 200 mg/dl showed a significant association with periodontitis with an OR of 1.9. A weak negative correlation had been found between CAL and Salivary pH (Figure 2) and CAL and Salivary buffering capacity among study subjects (Figure 3).

Discussion

Periodontitis is a complex immuno-inflammatory disease of the supporting tissues of the teeth characterized by loss of clinical attachment, destruction of the periodontal ligament with subsequent alveolar bone loss. From the literature, it is evident that the periodontal disease burden is increased with aging [1-3]. This is primarily due to prolonged exposure to risk factors and the contribution of anatomical and functional changes in periodontal tissues during the aging process. This may affect the host response to plaque bacteria and may

Risk factors	Moderate-severe periodontitis (%)	No/mild periodontitis (%)	P-value	Odds ratio
Smoking +	19 (82.6)	4 (17.4)	0.29	0.54 (0.17 to 1.6)
Smoking -	338 (89.7)	39 (10.3)		
FBS ≥ 100 mg/dl	219 (91.3%)	20 (8.3%)	0.03*	2.02 (1.04 to 3.5)
FBS ≤ 100 mg/dl	135 (84.4%)	25 (15.6%)		
TC > 200 mg/dl	222 (91.7%)	20 (8.3%)	0.04*	1.9 (1.00 to 3.5)
TC < 200 mg/dl	135 (85.4%)	23 (14.6%)		
TG > 150 mg/dl	88 (90.7%)	9 (9.3%)	0.43	1.36 (0.63 to 2.93)
TG < 150 mg/dl	135 (87.8%)	25 (12.2%)		
LDL > 130 mg/dl	204 (91.1%)	20 (8.9%)	0.18	1.53 (0.81 to 2.8)
LDL 60 - 130 mg/dl	153 (86.9%)	23 (13.1%)		
HDL <60 mg/dl	273 (90.1%)	30 (9.9%)	0.33	0.40 (0.70 to 2.8)
HDL > 60 mg/dl	84 (86.9%)	13 (13.2%)		
VLDL > 30 mg/dl	88 (89.8%)	10 (10.2%)	0.84	1.08 (0.51 to 2.2)
VLDL < 30 mg/dl	269 (89.1%)	33 (10.9%)		

Table 9: *Association of risk factors on periodontitis in group 1 and the group 2 subjects.*

*P: Probability value *P < 0.05 significant; FBS: Fasting Blood Sugar; TC: Total Cholesterol; TG: Triglycerides; HDL: High-Density Lipoprotein; LDL: Low-Density Lipoprotein; VLDL: Very Low-Density Lipoprotein; SD: Standard Deviation.*

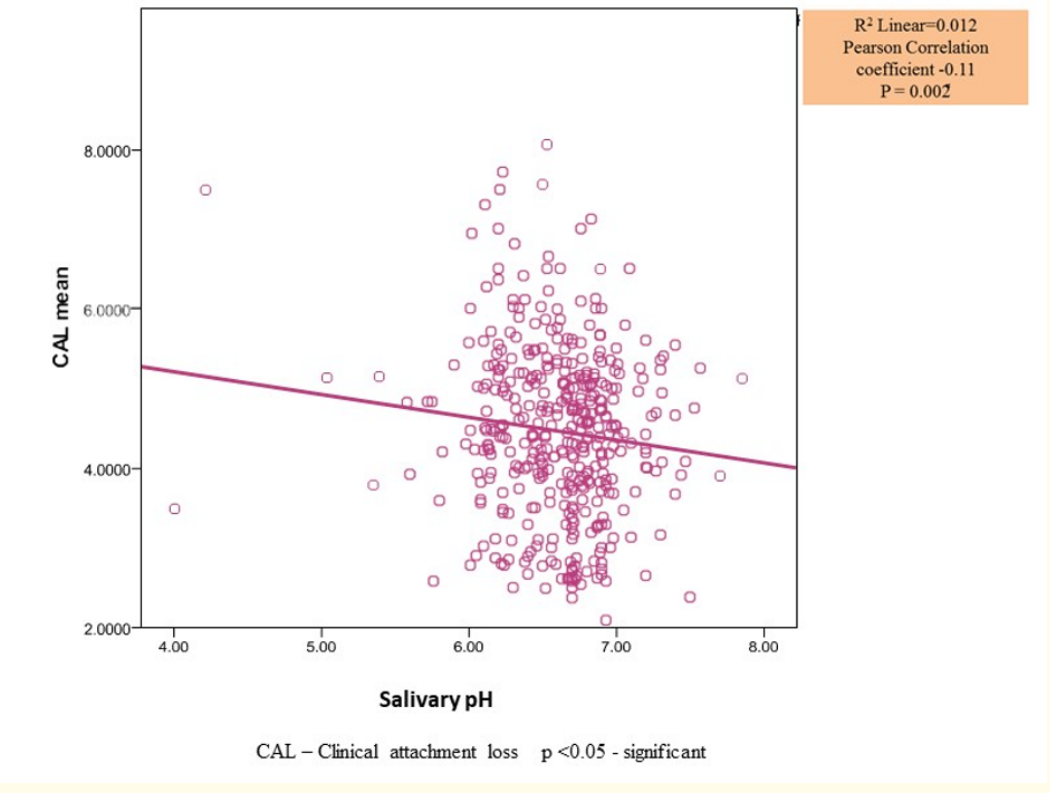

Figure 2: *Correlation between CAL and salivary pH in group 1 and group 2 subjects.*

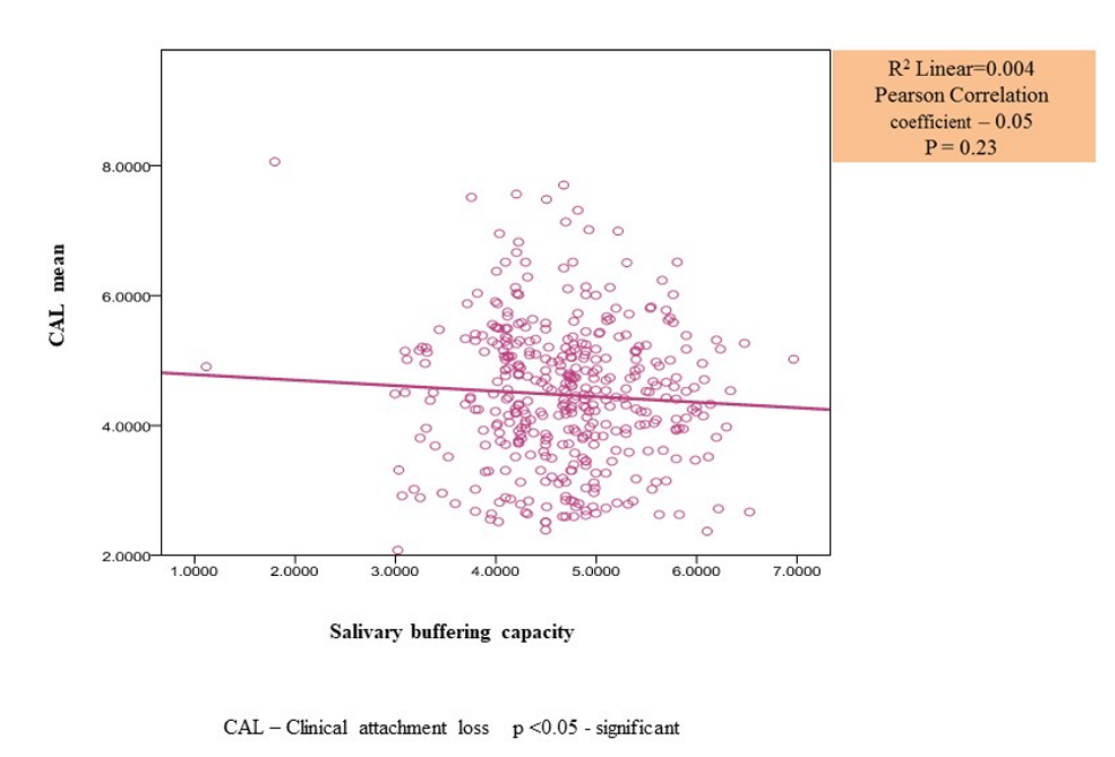

Figure 3: *Correlation between CAL and salivary buffering capacity in group1 and group 2.*

aggravate the rate of periodontal destruction in older people and improving oral health may significantly enhance the quality of life of the elderly.

The mean age of subjects in group 1 and group 2 was 54.46 years and 64.54 years respectively. There was no significant difference in oral hygiene practices between group 1 and group 2, more than 95% of the subject participated in this study were used toothbrush and toothpaste for tooth cleaning. This could be attributed to the fact that the subject in the present study has a high level of education (93%). A high education level implies a greater awareness of oral hygiene habits.

Even though a high percentage of the subject in the present study were used toothbrushes as the method and toothpaste as the material of tooth cleaning, but the OHI-S score was higher in group 2 as compared to group 1 subjects. This may be due to a decrease in manual dexterity with age. Shin., *et al*. in 2019 also reported a reduced manual dexterity in the elderly and they suggested, manual dexterity may be a predictor of poor oral hygiene in the elderly [18]. Moreover, the lack of knowledge about the correct brushing technique, unfavourable attitude towards dental health and changes in structure and function during aging was also contributed to the high score of OHI-S in group 2. In this study, there was a significantly higher mean DMFT with higher missing and decayed tooth scores in the group 2 subjects as compared to the group 1. Open tooth contact and altered chewing associated with missing teeth and the untreated carious lesion may also contribute to higher OHI-S in group 2 subjects.

Gingival inflammation associated with dental plaque is the main etiological factor for the onset of periodontitis. Modified gingival index [15] was used in this study to assess gingival inflammation. MGI was significantly higher in group 2 (2.70 ± 0.49) as compared to the group 1 (2.61 ± 0.42). The higher gingival index in group 2 may be due to the presence of high OHI-S. In accordance with this study Holm-Pedersen., *et al*. reported an increased gingival inflammation with greater gingival index in older adults with altered host response to the microorganisms of the plaque than in younger adults [19]. Braimoh and Alade also reported an increased gingival inflammation in the elderly due to the lifetime accumulation of local factors [20].

Periodontal parameters like Probing pocket depth, gingival recession and clinical attachment loss are the common tools to assess the burden of periodontal disease. In the present study, there was a significant difference in mean PPD, CAL and gingival recession between group 1 and group 2 subjects. One of the interesting findings in this study was that even though the clinical attachment level was high in the group 2, the mean PPD was significantly lower in group 2 as compared to group 1. This could be attributed to the fact that the group 1 subjects had a significantly high gingival recession as compared to group 1 and the subjects in the group 2 had a high periodontal disease burden. In accordance with this study, Ship JA and Beck JD., *et al*. reported a greater CAL in the elderly than younger groups due to increased recession [21]. Sarpangala Mythri., *et al*. in 2015 also reported an age-associated increased gingival recession in older adults [22]. In the present study presence of local factors, inflammation and contribution of anatomical factors such as exposed roots, irregular tooth surfaces were more in group2, which favoured increased gingival recession and more attachment loss in the group 2. Becker., *et al*. and Berglund., *et al*. suggested that, gingival recession is not an inevitable physiologic process of aging but rather that it can be explained by the cumulative effects of inflammation or trauma on the periodontium [23,24].

Considering the severity of periodontal disease, group 2 subjects (36%) had significantly more severe periodontitis than group 1 subjects (25%). Severe periodontitis in group 2 may be due to increased gingival recession and increased clinical attachment loss. In addition to this, inadequate oral hygiene maintenance, poor plaque control measures may also contribute to the severity of periodontitis. In accordance with the present study, GroHolde., *et al*. 2017 reported 35% of severe periodontitis in older adults [1]. Holm-Pedersen and colleagues from Sweden reported 50.5% of severe periodontitis in 80 yrs of age [25]. Contrasting reports are also available in the literature. In Norwegian Circumpolar Community studies evaluating periodontitis with the CDC/AAP case definition in 20 to 79 years old adults had 9.1% severe periodontitis [1]. The lower prevalence in the Norwegian study could partly be explained by differences in the age of study subjects and the presence of greater proportions of people with middle and high levels of education. The extent of periodontal disease was measured as a percentage of the site with > 1 mm clinical attachment loss. A generalized periodontal disease was observed among study subjects. The subjects in the group 2 showed a significantly higher mean percentage of sites with CAL ≥ 6 mm (28.5%) as compared to the group 1 (23.4%). This study showed a high proportion of severe periodontitis and a higher mean percentage of sites with CAL ≥ 6 mm ingroup 2 subjects. The burden of extent and severity of periodontal disease was high in group 2 subjects as compared to group 1 subjects.

In the present study, the mean salivary pH and buffering capacity between groups were statistically significant. pH was more acidic and the buffering capacity was low in group 2. This may be either due to the increased microbial activity associated with severe periodontitis or due to the degenerative changes of salivary glands associated with aging. No age-wise comparative studies were available in the literature regarding salivary pH and buffering capacity. Galgut., *et al*. and Baliga., *et al*. reported a correlation of salivary pH and buffering capacity with periodontitis [26,27]. In the present study, there was a negative correlation between salivary pH and buffering capacity with CAL. In accordance with our study, Galgut reported significant negative correlations between pH and periodontal pockets and they suggested that the acidic pH of saliva may be due to the activity of periodontal pathogens [26]. From this study, it is clear that assessing the salivary pH before advising acidic or alkaline antiplaque agents is beneficial to the patient.

The bidirectional link between periodontitis and systemic diseases such as diabetes mellitus [4-6,27], dyslipidemia [7,8], cardiovascular disease [4,28] is well established. In this study mean FBS, LDL were significantly higher in group 2 and HDL was significantly higher in

the group 1. Lal V., *et al*. observed a positive link between periodontitis and elevated serum lipid levels and they explained that elevated serum lipid levels might be due to the effect of LPS of dental plaque bacteria [7]. Sumit Tiwari., *et al*. and Panickal., *et al*. demonstrated significantly higher levels of serum lipid levels in subjects with chronic periodontitis when compared with healthy controls [29,30]. Even though the association between periodontitis and dyslipidemia was reported in the literature, no age-wise comparative studies are available in the literature.

In the present study, TC had an odds ratio of 1.9, demonstrating that subjects with high serum total cholesterol have 1.9 times at risk to have periodontitis. Periodontitis and hyperlipidemia share some common risk factors such as LPS-related responses, hyper-responsive monocytes, genetic and underlying pathologic mechanisms. Studies in the literature showed that statin use by hyperlipidemic patients has been shown to influence periodontal health [8,31]. This study showed that there was a significant association between FBS and periodontitis with an odds ratio of 2.02. It demonstrated that subjects with FBG ≥ 100 mg/dl were 2.02 times increased risk of developing moderate-severe periodontitis than subjects with FBG ≤ 100 mg/dl. In accordance with our study, many authors have also reported a positive association of diabetes with periodontitis [32,33]. Earlier studies showed a positive association between smoking and periodontitis [34], but this study found a contradictory result. This may be due to the presence of a very low number of smokers (among 400 study subjects, 375 subjects were non-smokers) in the present study.

One of the limitations of this study is that it is not possible to determine causality due to the cross-sectional design. Periodontal parameters were measured manually using Williams's graduated periodontal probe. More accurate results can be obtained with a new generation computerized probe.

Conclusion

The extent and severity of periodontal disease were higher in group 2 as compared to the group 1. The pH of the saliva was more acidic and the buffering capacity was low in group 2. Age-associated structural and functional changes in the periodontium, changes in salivary characteristics, prolonged exposure to risk factors like hyperglycemia and dyslipidemia are significantly associated with worsening of periodontal health. Assessment of salivary pH before advising antiplaque agents is beneficial to group 2 subjects. Effective and specific oral and periodontal health program in group 2 subjects is mandatory to improve general health and quality of life of the elderly.

Acknowledgements

We acknowledge the financial assistance provided by the Indian Council of Medical Research (ICMR) for carrying out this study.

Conflict of Interest

Nil.

Bibliography

1. Holde GE., *et al*. "Periodontitis Prevalence and Severity in Adults: A Cross-Sectional Study in Norwegian Circumpolar Communities". *Journal of Periodontology* 88.10 (2017): 1012-1022.

2. Srivastava R., *et al*. "Prevalence of dental caries and periodontal diseases, and their association with socio-demographic risk factors among older persons in Delhi, India: a community-based study". *The Southeast Asian Journal of Tropical Medicine and Public Health* 44.3 (2013): 523-533.

3. Shewale AH., *et al*. "Prevalence of Periodontal Disease in the General Population of India-A Systematic Review". *Journal of Clinical and Diagnostic Research* 10.6 (2016): ZE04-ZE09.

4. Oberoi SS., *et al*. "A cross-sectional survey to study the relationship of periodontal disease with cardiovascular disease, respiratory disease, and diabetes mellitus". *Journal of Indian Society of Periodontology* 20.4 (2016): 446-452.

5. Firatli E., *et al*. "The relationship between clinical attachment loss and the duration of insulin-dependent diabetes mellitus (IDDM) in children and adolescents". *Journal of Clinical Periodontology* 23.4 (1996): 362-366.

6. Mashimo PA., *et al*. "The periodontal microflora of juvenile diabetics. Culture, immunofluorescence, and serum antibody studies". *Journal of Periodontology* 54.7 (1983): 420-430.

7. Lal V., *et al*. "Effect of chronic periodontal infection on systemic lipid profile: A clinical and biochemical study". *Journal of the International Clinical Dental Research Organisation* 7 (2015): 106-110.

8. Fu YW., *et al*. "Effects of periodontal therapy on serum lipid profile and proinflammatory cytokines in patients with hyperlipidemia: a randomized controlled trial". *Clinical Oral Investigations* 20.6 (2016): 1263-1269.

9. Nazir MA. "Prevalence of periodontal disease, its association with systemic diseases and prevention". *International Journal of Health Sciences* 11.2 (2017): 72-80.

10. Guiglia R., *et al*. "Aging and oral health: effects in hard and soft tissues". *Current Pharmaceutical Design* 16.6 (2010): 619-630.

11. Petersen PE and Yamamoto T. "Improving the oral health of older people: the approach of the WHO Global Oral Health Programme". *Community Dentistry and Oral Epidemiology* 33.2 (2005): 81-92.

12. Gopalankutty N., *et al*. "Prevalence of periodontitis and its correlates among tribal population of Attapady block, Palakkad District, Kerala". *Journal of Indian Society of Periodontology* 24.3 (2020): 264-270.

13. Eke PI., *et al*. "Periodontitis prevalence in adults ≥ 65 years of age, in the USA". *Periodontology 2000* 72.1 (2016): 76-95.

14. Eke PI., *et al*. "Update of the case definitions for population-based surveillance of periodontitis". *Journal of Periodontology* 83.12 (2012): 1449-1454.

15. Lobene RR., *et al*. "A modified gingival index for use in clinical trials". *Journal of Clinical Preventive Dentistry* 8.1 (1986): 3-6.

16. Greene JC and Vermillion JR. "The Simplified Oral Hygiene Index". *Journal of the American Dental Association* 68 (1964): 7-13.

17. Ericson D and Bratthall D. "Simplified method to estimate salivary buffer capacity". *Scandinavian Journal of Dental Research* 97.5 (1989): 405-407.

18. Shin NR and Choi JS. "Manual dexterity and dental biofilm accumulation in independent older adults without hand disabilities: A cross-sectional study". *Photodiagnosis and Photodynamic Therapy* 25 (2019): 74-83.

19. Holm-Pedersen P., *et al*. "Experimental gingivitis in young and elderly individuals". *Journal of Clinical Periodontology* 2.1 (1975): 14-24.

20. Braimoh OB and Alade GO. "Gingivitis and Periodontitis among the Elderly in Port Harcourt Nigeria: A Population-based Study". *Journal of Oral Health and Community Dentistry* 13 (2019): 5-9.

21. Ship JA and Beck JD. "A ten-year longitudinal study of periodontal attachment loss in healthy adults". *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology* 81.3 (1996): 281-290.

22. Mythri S., *et al*. "Etiology and occurrence of gingival recession - An epidemiological study". *Journal of Indian Society of Periodontology* 19.6 (2015): 671-675.

23. Baker DL and Seymour GJ. "The possible pathogenesis of gingival recession. A histological study of induced recession in the rat". *Journal of Clinical Periodontology* 3.4 (1976): 208-219.

24. Berglundh T., *et al*. "Clinical and structural characteristics of periodontal tissues in young and old dogs". *Journal of Clinical Periodontology* 18.8 (1991): 616-623.

25. Holm-Pedersen P., *et al*. "Periodontal disease in the oldest-old living in Kungsholmen, Sweden: findings from the KEOHS project". *Journal of Clinical Periodontology* 33.6 (2006): 376-384.

26. Galgut PN. "The relevance of pH to gingivitis and periodontitis". *International Academy of Periodontology* 3.3 (2001): 61-67.

27. Baliga S., *et al*. "Salivary pH: A diagnostic biomarker". *Journal of Indian Society of Periodontology* 17.4 (2013): 461-465.

28. Beck J., *et al*. "Periodontal disease and cardiovascular disease". *Journal of Periodontology* 67.10 (1996): 1123-1137.

29. Tiwari S., *et al*. "Association between periodontitis and hyperlipidemia". *Indian Journal of Scientific Research* 5 (2016): 1655-1657.

30. Panickal DM., *et al*. "Estimation of serum lipid levels in chronic periodontitis patients: a case-control study". *IJCRR: International Journal of Current Research and Review* 8 (2016): 23.

31. Cholesterol, C-Reactive Protein, and Periodontitis: HMG-CoA-Reductase Inhibitors (Statins) as Effect Modifiers (2020).

32. Maboudi A., *et al*. "Relation between Periodontitis and Prediabetic Condition". *Journal of Dentistry* 20.2 (2019): 83-89.

33. Oyapero A., *et al*. "Effect of glycemic control on periodontal disease and caries experience in diabetic patients: A pilot study". *Journal of Interdisciplinary Dentistry* 9 (2019): 99-107.

34. Tomar SL and Asma S. "Smoking-attributable periodontitis in the United States: findings from NHANES III. National Health and Nutrition Examination Survey". *Journal of Periodontology* 71.5 (2000): 743-751.

Volume 22 Issue 1 January 2023