Research Article

PERIODONTAL DISEASE AS A RISK FACTOR OF ATHEROSCLEROTIC CARDIOVASCULAR DISEASES IN ADULT PATIENTS VISITING AYDER COMPREHENSIVE SPECIALIZED HOSPITAL

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ABSTRACT
Background: Oral health is an integral component of general health and well-being of an individual. A chronic bacterial oral disease such as periodontitis has been considered as a separate risk factor for cardiovascular diseases, cerebrovascular diseases and peripheral arterial disease. The possible pathways linking oral infections to systemic diseases are metastatic infections, bacterial endotoxins, and systemic vascular injury. **Objective:** the aim of this present study was to evaluate an association between clinical parameters of periodontal disease and cardiovascular diseases in adult patients visiting Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia. **Method and Materials**: a total 50 patients, 26 males and 24 females aged 40 to 79 years were selected for the study. Information concerning with various cardiovascular diseases like hypertension, coronary heart disease, heart attack and cardiac arrhythmia were collected. Clinical parameters of periodontal disease were recorded like gingival index(GI), probing pocket depth (PPD), bleeding on probing (BOP) and clinical attachment at six sites on each tooth (facial, lingual, distolingual, mesiolingual, distofacial and mesiofacial). The severity of gingivitis was also measured. **Result:** A significant association between gingival inflammation (RR =11.25), CAL (RR=14.67), BOP (RR=14.67), PPD (RR=11.25) and ACVD was found, whereas no association was found between periodontal disease indices and HA. **Conclusion:** Serological differences in subjects with periodontitis, some of which involve established risk factors for atherosclerosis, might provide insight into the reported epidemiological association between periodontitis and cardiovascular disease.

Keywords: Atherosclerosis Diseases, periodontitis, gingival inflammation and risk factors.

INTRODUCTION

Periodontal diseases are chronic inflammatory diseases affecting gums and are associated with destruction of tooth supporting tissues caused by dental plaque[1]. Periodontal diseases are common oral diseases with high prevalence worldwide[2]. Severe forms of periodontitis affect around 11% of the world population[3]. The disease progresses slowly for decades and is influenced by several risk factors such as age, smoking, or systemic conditions that worsen host-immune response[4].

Recent studies have shown that periodontal diseases represent a potential risk factor for several systemic conditions, including cardiovascular diseases. Cardiovascular disease is the second most common cause of death worldwide. In South Africa, 14.7% of reported deaths are attributed to diseases of the

circulatory system[5]. The global trend is somewhat higher, with approximately 30% of all deaths caused by atherosclerotic vascular disease[6]. Atherosclerosis is the common platform from which all other clinical cardiovascular modalities arise, including ischaemic heart disease, cerebrovascular disease and also disease of the peripheral circulation. Lack of early diagnosis and or failure in management can predispose potentially fatal events, like myocardial infarction, stroke and acute coronary syndromes[7,8,9].

Periodontitis and dental procedures can be potential factors in transient bacteremia[10,11]. Several mechanisms have been proposed to explain the association between periodontal and cardiovascular disease. Periodontitis causes both a local and systemic inflammatory and immune response, with increase in white blood cell count, C-reactive protein, fibrinogen, cell adhesion molecules, and proinflammatory cytokines[12]. In addition, pathogens from the mouth can enter atherosclerotic plaques via the blood stream, and this could promote an inflammatory or immune response within the atherosclerotic plaque[13,14]. In animal models, infection with Porphyromonas gingivalis increases atherosclerotic plaque volume with the accumulation of cholesterol esters and inflammatory mediators[15].

Although there is a strong pathophysiological rationale to support the importance of these mechanism, it is possible the association between periodontitis and atherosclerotic vascular disease is not causal. In almost all observational studies, at least part of the association is explained by adjustment for cardiovascular risk factors. Smoking, diabetes mellitus, increasing age, and poor socioeconomic status are risk factors for periodontitis, and for cardiovascular disease, as well[16]. However, despite the increased evidence, neither a consensus has yet emerged on the existence or relevance of such an association nor on the level of impact of one disease over the other. And also whether periodontal intervention can be used as a therapeutic strategy to reduce atherosclerosis diseases is unknown. Therefore, this study focuses on the influence of periodontitis on atherosclerosis diseases and also to understand the common risk factors commonly shared between periodontitis and various subgroups of cardiovascular diseases.

METHODOLOGY
A comparative cross-sectional, analytical study was carried out at a dedicated Mekelle Hospital. Tigray region, Ethiopia. Before initiating the study, a study protocol was first approved by MU,CHS, Research and Community Office, Ethiopia.

Participants were sampled randomly based on their cardiovascular diseases subgroups. In order to acquire a representative study sample the study population was stratified by age and sex. Thus, a sample of 50 patients, 26 males and 24 females aged 40 to 79 years were selected for the study using following inclusion and exclusion criterias

Inclusion Criteria
1) Age of the patient between 40 to 79 years.
2) Presence of at least 20 natural teeth

Exclusion Criteria
1) Uncooperative adults.
2) Pregnant females or lactating mothers.
3) Periodontal therapy in preceding 6 months
4) Systemic antibiotics or anti-inflammatory or other systemic medication during the previous 6 weeks.
5) Patients suffered from acute infections and malignant diseases
6) Third molars and remained roots

Prior to initiating study, the purpose and design of the study was explained to patient and informed consent was signed by every patient. Then semi-structured, self-administered questionnaires were used to obtain information on the socio demographic characteristics of the participants. The questionnaires consisted of following questions like: demographic profile, medical and health history including several chronic or systemic diseases or pathological conditions. In addition, information concerning with various cardiovascular diseases like hypertension, coronary heart disease, heart attack and cardiac arrhythmia were also collected. Participants medical files were also used in case they failed to mention details of their medical history concerned with the clinical parameters examined.

Oral health information such as the frequency of cleaning and type of cleaning was recorded in the specially designed chart. Also, clinical parameters of periodontal disease were recorded like gingival index(GI), probing pocket depth (PPD), bleeding on probing (BOP) and clinical attachment loss (CAL) using Marques periodontal probe at six sites on each tooth (facial, lingual, distolingual, mesiolingual, distofacial and mesiofacial). The severity of gingivitis was scored according to Loe and

Silness classification Score 0: no pathological conditions of gingiva, Score 1: mild gingival inflammation, Score 2 and 3: moderate/severe gingiva inflammation respectively.

Statistical analysis

Statistical analysis of the data was done using Statistical Package for Social Sciences (SPSS) 11.0 version and Excel 2000. The mean and standard deviation (Mean ± SD) values were calculated for the clinical parameters including PPD, CAL, and BOP in all the 4 subgroups of cardiovascular diseases. The mean data was analyzed for the statistical significance by standard statistical method. Pearson's Chi-square tests of association, t-test and analysis of variance were used to compare qualitative and quantitative variables where appropriate. Analyses were performed at 95% confidence level therefore probability value (*p*) less than 0.05 was considered statistically significant.

RESULTS

The study sample consisted of 50 outpatients with a mean age of 57.1 years giving a response rate 83.3.%. Current smokers were 58% out of which 52% were males and only 6% were females.

Table 1: shows frequencies of atherosclerotic cardiovascular disease and its subgroups according to epidemiological variables. From total 50 participants, 9 participants had ACVD (18%), 6 had HTN (12%), 2 were having CHD (4%), 0 had HA (0%), while only 1 had CA (2%)

Variables		Total ACVD	HTN	CHD	HA	CA
Sex	Male	4	3	1	0	0
	Female	5	3	1	0	1
Age	40-49	0	0	0	0	0
	50-59	3	2	1	0	0
	60-69	3	2	1	0	0
	70-79	3	2	1	0	0
Socioeconomic status	High	5	4	1	0	0
	Low	4	3	0	0	1
Dental Follow-up	Regular	3	2	1	0	0
	Irregular	6	4	1	1	0
Smoking status	Yes	6	4	1	1	0
	No	3	2	1	0	0

Table 2: Below presents association in periodontal disease parameters and various cardiovascular subgroups. It was shown that 22 participants had periodontal diseases (44%), 5 participants had gingival inflammation (10%), 5 were having PPD (10%), 6 had CAL (12%) and 6 participants showed BOP (12%), whereas the other 19 had no defined periodontal disease parameters

Table 2: Association between Periodontal disease parameters and ACVD subgroups

	Periodontal diseases			
	Gingival Inflammation	PPD	CAL	BOP
ACVD	5	5	6	6
HTN	3	3	3	3
CHD	1	1	2	2
HA	0	0	0	0
CA	1	1	1	1
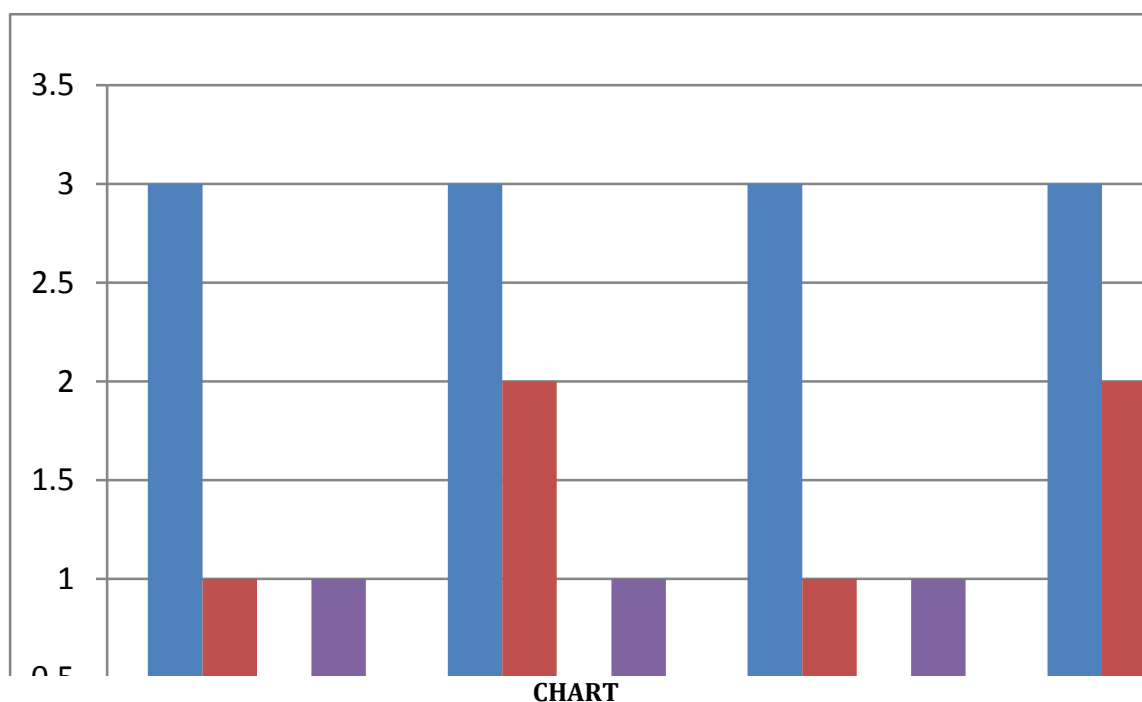
CHART

The above chart shows the association among the periodontal disease indices and ACVD and its subgroups. Associations were found between PPD and all ACVD except HA, and also between CAL and all ACVD subgroups except HA. BOP and all ACVD subgroups except HA.

Table 3: shows the relative risk of periodontal indices to ACVD and its subgroups. Individuals with gingival inflammation had RR of 11.25 for ACVD, RR of 9 for HTN & CHD subgroups, while 0 for HA subgroup. Also, individuals with RR of 11.25 for ACVD, RR of 9 for both HTN & CHD subgroups, while 0 for HA subgroup. Individuals with CAL and BOP with RR of 14.67 for ACVD, RR of 7.33 for HTN and 0 relative risk for HA, while relative risk was impossible to calculate for CA in relation with all the periodontal diseases

	ACVD	HTN	CHD	HA	CA
	RR	RR	RR	RR	RR
Ging.Inf.	11.25	9	9	0	†
PPD	11.25	9	9	0	†
CAL	14.67	7.33	†	0	†
BOP	14.67	7.33	†	0	†

±.......shows where it is impossible to calculate association

DISCUSSION

Periodontal disease is a chronic infection and degree of inflammation in periodontal disease is clearly sufficient to cause systemic inflammatory response, as evidence by increase in C-reactive protein. The presence of periodontal infection may lead to brief episodes of bacteremia with inoculation of atherosclerotic plaques by periodontal pathogens. Subsequent growth of these bacteria would cause inflammation and plaque instability which may precipitate the ischemic attack.

Several authors rigorously tested whether periodontal disease was associated with CVD independent of risk factors common to both conditions. Specifically, most studies reported positive associations after accounting for the effects of multiple risk factors such as age, sex, diabetes, cholesterol levels, blood pressure, obesity, smoking status, dietary patterns, race/ethnicity, education and socioeconomic status. [17-22].

In present study, males showed higher prevalence of cardiovascular and periodontal disease. Reports from the United States and Germany have provided evidence that the association between periodontal disease and CVD might be stronger among men than among women[21,23,24]. The possibility that novel risk factors might partly explain some of the sex differential in CVD risk is intriguing. For example, in SHIP, Desvarieux and colleagues reported that men had more severe periodontal disease than did women, raising the possibility that women did not reach athreshold of inflammation necessary for systemic effects[25].

Age is an important factor associated with both periodontitis and cardiovascular diseases as risk of both increases with age. Most of the studies done to see the association between CVD and periodontitis had included study subjects from age of 40 years. The present study included study group from 30 years of age as incidence of heart disease is increasing from 30 years of age. The age limit is restricted at the age of 65 years to avoid any possible bias due to presence of CHD related to physiological changes in older patients[26].

The results have particular importance in the case of smoking, as some have postulated that the association between periodontal disease and CVD is due to smoking-related bias[27]. In present study 58% of the male participants were current smokers. In a study done by Morrison and colleagues, they observed that participants with periodontal disease had more risk of developing fatal coronary heart disease and experiencing stroke even after controlling for smoking status by classifying current smokers according to the number of cigarettes smoked per day[20]. Others have controlled for smoking by restricting their analyses to never-smokers. Joshipiura and colleagues reported an 80 percent elevation in stroke risk for people with zero to 24 teeth compared with those who had 25 or more teeth among never-smokers[22]. Desvarieux and colleagues reported similar findings between tooth loss and carotid atherosclerosis, unmodified by smoking status[28]. Nevertheless, underlying the "confounding by smoking" argument is the possibility of a healthy bias effect, in which people who smoke are more likely to have unhealthy lifestyles, which can lead to both periodontal disease and CVD.

Also, this study showed that the prevalence of CVD in patients with periodontitis was 12%, which is in support with the study done by Slavkin HC et al who reported that the prevalence of CVDs in patients with periodontitis is 25-50% higher than in healthy individuals[29]. Moreover, poor self-reported oral health, as a possible risk factor for periodontitis, and tooth loss, as a possible consequence of periodontitis, are positively associated with a coronary atherosclerotic burden[30]. However, it should be noted that much of the evidences that confirmed the link between CVDs and periodontal disease were generated by observational studies and so further studies with more robust designs should be carried out to provide answers regarding the real association between periodontitis and CVDs, like atherosclerosis.

The present study showed that periodontal disease could be an index of an increased risk for ACVD. Individuals with gingival inflammation had a RR of 11.25 to suffer from any kind of ACVD, such as CHD and HTN. However, hypertension showed a particularly significant association with gingival inflammation. This observation is in agreement with the previous studies [31,32].

Limitation

One of the major limitations for this study was some essential biomarkers (cytokines, C-RP) were not recorded due to lack of those technologies that were important for identification of those biomarkers. Also, the study showed a lack of control of confounding factors, residual confounders, and over-control of cofounders. Last but not the least small sample size was the major limitation.

CONCLUSION

Even though periodontal disease may be less of a risk factor when compared to smoking and

LDL, the control of this chronic inflammatory disease should be part of the protocol for management of atherosclerosis, HTN, CHD, and CA. Periodontal therapy is another means of potentially modifying a risk factor and reducing the morbidity associated with these cardiovascular disease processes. The evidence of direct and indirect systemic influences of periodontal pathogens on medical conditions continues to emerge through longitudinal studies and will result in an increased emphasis for improving medical health through dental health.

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