



ASSOCIATION BETWEEN HYPERTENSION AND CHRONIC PERIODONTITIS: A CLINICAL STUDY.

Dental Science

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ABSTRACT

Background: Periodontal disease has been in focus because of its potential relationship with cardiovascular diseases, as a chronic inflammatory condition linked with systemic markers of inflammation and endothelial dysfunction.

Aim: To evaluate the prevalence of hypertension in chronic periodontitis patients and compare the periodontal status of hypertensive, non-hypertensive and pre-hypertensive subjects. An attempt was also made to find out association between chronic periodontitis and hypertension.

Study Design: A total of 180 subjects suffering from chronic periodontitis were selected and categorized in to three groups on the basis of blood pressure measurements.

Methods And Material: Periodontal status of all groups were evaluated and compared to find out association between chronic periodontitis and hypertension, if any.

Statistical Analysis: One way Anova test was performed to find significant difference of clinical parameters among different groups. Karl Pearson's correlation was used to find association between chronic periodontitis and hypertension.

Results: Inter group comparisons of periodontal parameter of three groups yielded statistically non significant results. However, comparison of bleeding on probing score of HT group, PHT group and NBP group yielded statistically significant results ($P < 0.001$). A positive correlation was found between systolic blood pressure, probing pocket depth and clinical attachment level. Bleeding on probing was found to be positively correlated with both systolic and diastolic blood pressure.

Conclusion: It can be concluded that chronic periodontitis and hypertension are associated with each other, but future research with larger sample sizes, longitudinal follow ups and confounding analysis in different population groups is warranted to further explore the links between these two diseases.

KEYWORDS

Chronic periodontitis, Hypertension, Systemic health, Probing pocket depth

INTRODUCTION

Periodontitis is inflammation of the periodontium that is accompanied by apical migration of junctional epithelium, leading to destruction of connective tissue attachment and alveolar bone loss. Chronic periodontitis is most common form of destructive periodontal disease.[1,2] Recently periodontal disease has been in focus because of its potential relationship with cardiovascular diseases, as a chronic inflammatory condition linked with systemic markers of inflammation and endothelial dysfunction.[3] It is evident that localized disease such as periodontal disease may indeed influence a number of systemic diseases.[4] Previous reports have also suggested associations between chronic periodontal disease and systemic conditions. [5,6] Current epidemiological evidence also supports potential association of chronic inflammatory process with increase in blood pressure and hypertension prevalence.[7-11] In contrast, some clinical studies did not report any association between periodontal disease and hypertension.[12] Furthermore, a study by Lagervall, did not found any association between chronic periodontal disease and systemic diseases.[13]

Till date, only a few studies have reported on the association between chronic periodontitis and hypertension, producing inconsistent results. The present study was conducted to evaluate the prevalence of hypertension in chronic periodontitis patients and compare the periodontal status of hypertensive, non hypertensive and prehypertensive chronic periodontitis subjects. An attempt was also made to find out association between these two conditions, if any.

MATERIALS AND METHODS

Study Population

Subjects were residents of Lahore City, Punjab, Pakistan. Out of 320 screened subjects, 120 refused to participate in the study. Twenty subjects were excluded from the study because they did not fulfill the inclusion criteria. Both males and females with in age group of 30-70 years suffering from chronic periodontitis were included. Individuals

with habits of alcoholism, smoking or tobacco consumption in any form, systemic complications, aggressive periodontitis, on antibiotic and/or anticoagulant therapy were excluded. A written informed consent was obtained from all individuals prior to the study.

Clinical Parameter Recording

Periodontal examiners received training and calibration in periodontal parameter assessment and blood pressure (BP) measurements. A single operator recorded the following periodontal parameters:

1. Probing pocket depth (PPD): It was measured as a distance from gingival margin to base of the periodontal pocket using UNC-15 periodontal probe.
2. Clinical attachment level (CAL): It was measured as a distance from the cemento-enamel junction of the tooth to base of the periodontal pocket using UNC-15 periodontal probe.
3. Bleeding on probing [14] (BOP), Plaque index [15] (PI), Gingival index [15] (GI) of all the subjects were also recorded.

BP Measurement: Participants arm length and circumference were first measured to determine the accurate cuff size. Subjects were made to rest for 5-10 minutes. Systolic blood pressure (SBP) and Diastolic blood pressure (DBP) were taken three times within 1-2 minute intervals, in sitting position, on the right arm of the participant, using bell stethoscope and a mercury sphygmomanometer. Average of three readings was recorded.

Study Protocol

On the basis of BP measurements [16] the subjects were categorized in the following

1. Group 1 (HT Group): Hypertensive group (SBP > 140 mm of Hg, DBP > 90 mm of Hg)
2. Group 2 (PHT Group): Prehypertensive (SBP 120-139 mm of Hg, DBP 80-89 mm of Hg)
3. Group 3 (NBP Group): Normal blood pressure (SBP < 120 mm of Hg, DBP < 80 mm of Hg)

Clinical parameters of all the groups were recorded and periodontal status of groups was evaluated and compared, and an attempt was made to find an association between hypertension (HT) and chronic periodontitis.

Statistical Analysis

Data were analyzed using SPSS version 16.0 (SPSS, Chicago, IL, USA). Descriptive statistics were obtained. One way Anova test was performed to find significant difference of clinical parameters among different groups. Karl Pearson's correlation was used to find out association between chronic periodontitis and HT.

RESULTS

A total of 180 subjects suffering from chronic periodontitis were enrolled in the study. For comparison of periodontal status and to find association between chronic periodontitis and HT, subjects were categorized into three groups depending upon their BP measurements.

Out of 180 chronic periodontitis subjects, 39.44% were found to be hypertensive, 40.55% were in prehypertensive stage and 20% subjects had normal blood pressure. Measurements of periodontal parameters of the groups are summarized in Table 1. Intergroup comparisons of CAL, PPD, PI, GI of three groups yielded statistically non significant results (Table 2).

However, comparison of BOP score of HT group with PHT group and NBP group yielded statistically highly significant results ($P < 0.001$). However, comparison of BOP score of HT group, PHT group and NBP group revealed statistically highly significant results ($P < 0.001$). But when BOP score of NBP group was compared with PHT group, it yielded statistically non-significant results ($P = 0.76$). It was observed that in HT group 33.80% subjects had severe periodontal disease as compared to 24.66% in PHT group and 19% in NBP group. A positive correlation was found between SBP, PPD and CAL (Table 3). However, DBP was not associated with PPD and CAL (Table 4). BOP was found to be positively correlated with both SBP and DBP (Table 5).

DISCUSSION

Periodontal disease can adversely affect the systemic health with manifestations such as coronary heart disease, stroke, diabetes, low birth weight, preterm labor, respiratory disease, erectile dysfunction etc.[6,17] Systemic diseases and disorders have also been implicated as risk indicators or factors in periodontal disease.[18]

In the present study, an attempt was made to evaluate prevalence of HT and PHT in chronic periodontitis patients and find an association between HT and chronic periodontitis. 180 subjects suffering from chronic periodontitis were enrolled in the study and they were categorized into 3 groups i.e HT, PHT and NBP group based on their BP measurements.[16] Periodontal disease was defined as a CAL ≥ 3 mm in atleast two sites and a pocket depth ≥ 4 mm.[1]

Results revealed that 39% of chronic periodontitis subjects had hypertension. 40% subjects were in prehypertensive stage and 20% subjects had normal BP. A previous study had also reported prevalence rate of 35.1%, 32.3% and 52.8% of hypertension in mild, moderate and severe periodontitis group respectively.[19] The results of our study are in accordance to this study. In 2013, Zainuddin et al. reported 10.8% prevalence of HT among chronic periodontitis subjects.[20] Prevalence rates of 12.2%, 22%, and 16% of HT in chronic periodontitis subjects had been reported in previous clinical studies.[12,21,22] Prevalence of HT in chronic periodontitis subjects varies among different populations. This may be attributed to different lifestyles among these populations. In addition, genetic factors might also play a vital role in causing HT in chronic periodontitis subjects. Several confounding factors such as smoking, stress, increased age and socioeconomic factors, might contribute to the same.[23] To overcome these confounding factors subjects who were non smokers, non alcoholics, similar socioeconomic status and age groups were included in the study. However, it is still not possible to eliminate all the confounding factors.

In the present study, 40% of enrolled chronic periodontitis subjects were found to be in prehypertensive stage. To best of our knowledge this is the first study to find out the prevalence of prehypertensive stage in chronic periodontitis subjects. 20% subjects had normal BP. It was found that percentage of subjects suffering from severe chronic

periodontitis was higher in HT group as compared to PHT and NBP group. Among HT group, 33.80% subjects had severe chronic periodontitis as compared to 24.66% in PHT group and 19% in NBP group.

A positive correlation between SBP, PPD and CAL was reported. It was observed that with increase in SBP, PPD and CAL values were increased continuously. This indicated an association between HT and chronic periodontitis. This finding is in accordance to previous studies[24,25], Volzke H et al.[26] and Tsakos G et al.[27] in their reports also reported the association between chronic periodontitis and hypertension. However, in our study DBP was not associated with PPD and CAL values. This finding supports the previous reports of Desvarieux et al.[28] Papapanagiotou et al.[29]. However, it is in contrast to the findings of Engstrom et al., [30] who reported a positive correlation between DBP and chronic periodontitis. A striking outcome of association between BOP with SBP and DBP was also revealed. BOP is hallmark of gingival disease. This suggested a strong association between gingivitis and HT. A well-known contribution of chronic periodontitis in systemic inflammation also supports the association between these two diseases.[6] Various possible linking pathways for the association between HT and chronic periodontitis may include inflammatory pathway, oral infection route, oxidative stress pathway and endothelial dysfunction.[26]

This study had few limitations. In our opinion, for subgroup analyses, the statistical power was not enough because of the relatively small sample size. Although a mean of three blood pressure readings was recorded but all of them were recorded on one occasion only, thus day to day variations of BP may have resulted in random misclassifications. The results of the study may not be generalized because it has been conducted only on one population group. Despite of these limitations, the study demonstrated a positive association between HT and chronic periodontitis, which may have a major public health impact.

CONCLUSION

From the results of our study, it can be concluded that chronic periodontitis and hypertension are associated with each other, but future research with larger sample sizes, longitudinal follow ups and confounding analysis in different population groups is warranted to further explore the links between these two diseases.

TABLES :-

Table 1: Summary Of Clinical Parameter Measurements

Group	Clinical parameters	N	Mean	Std. Deviation
HT GROUP	PI	71	1.92	0.45
	GI	71	1.75	0.51
	BOP	71	93.42	10.72
	CAL(in mm)	71	4.0	1.43
	PPD(in mm)	71	4.72	1.49
NBP GROUP	PI	36	2.16	0.52
	GI	36	1.89	0.68
	BOP	36	65.28	32.18
	CAL(in mm)	36	3.62	1.29
	PPD(in mm)	36	4.37	1.43
PHT GROUP	PI	73	1.85	0.56
	GI	73	1.69	0.52
	BOP	73	76.25	28.04
	CAL(in mm)	73	3.78	1.50
	PPD(in mm)	73	4.79	2.00

mm : millimeters

Table 2: Intergroup comparison of periodontal parameters among groups

Clinical Parameters	Group	Compared Group	Mean Difference	Std. Error	P value
PI	HT GROUP	NBP GROUP	0.24	0.10	0.065
		PHT GROUP	0.06	0.08	1
	NBP GROUP	HT GROUP	0.24	0.10	0.065
		PHT GROUP	0.30(*)	0.10	0.011*
	PHT GROUP	HT GROUP	0.064	0.08	1
		NBP GROUP	0.30(*)	0.10	0.011

GI	HT GROUP	NBP GROUP	0.13	0.11	0.735
	PHT GROUP		0.06	0.09	1
	NBP GROUP	HT GROUP	0.13	0.11	0.735
	PHT GROUP		0.20	0.11	0.237
	PHT GROUP	HT GROUP	0.06	0.09	1
BOP	NBP GROUP		0.20	0.11	0.237
	HT GROUP	NBP GROUP	28.13(*)	4.88	<.001**
	PHT GROUP		17.17(*)	3.98	<.001**
	NBP GROUP	HT GROUP	28.13(*)	4.88	<.001**
	PHT GROUP		10.96	4.86	0.076
CAL (In mm)	PHT GROUP	HT GROUP	17.17(*)	3.98	<.001**
	NBP GROUP		10.96	4.86	0.076
	HT GROUP	NBP GROUP	0.37	0.29	0.613
	PHT GROUP		0.21	0.23	1
	NBP GROUP	HT GROUP	0.37	0.29	0.613
PPD (In mm)	PHT GROUP		0.15	0.29	1
	PHT GROUP	HT GROUP	0.21	0.23	1
	NBP GROUP		0.15	0.29	1
	HT GROUP	NBP GROUP	0.35	0.34	0.919
	PHT GROUP		0.06	0.28	1
PPD (In mm)	NBP GROUP	HT GROUP	0.35	0.34	0.919
	PHT GROUP		0.42	0.34	0.685
	PHT GROUP	HT GROUP	0.06	0.28	1
	NBP GROUP		0.42	0.34	0.685

*Statistically Significant

** Statistically highly Significant
mm: millimeters

Table 3: Correlation of SBP with CAL and PPD

SBP		CAL	PPD
	Pearson correlation	-0.160*	-0.200**
	Sig. (2-tailed)	0.320	0.007
	N	180	180

*Statistically Significant

** Statistically Highly Significant

Table 4: Correlation of DBP with CAL and PPD

DBP		CAL	PPD
	Pearson correlation	0.060	0.063
	Sig. (2-tailed)	0.426	0.401
	N	180	180

Table 5: Correlation of BOP with SBP and DBP

BOP		SBP	DBP
	Pearson Correlation	.249(**)	.328(**)
	Sig. (2-tailed)	.001	.000
	N	180	180

** Statistically highly significant

REFERENCES

- Flemming TF. Periodontitis. Ann Periodontol 1999;4:32-8.
- Lindhe J, Ranney R, Lamster I. Consensus report: Chronic Periodontitis. Ann Periodontol 1999;38.
- Joshi KJ, Wand HC, Merchant AT, Rimm EB. Periodontal disease and biomarkers related to cardiovascular disease. J Dent Res 2004; 83(2): 151-5.
- Scannapieco FA. Systemic effects of periodontal diseases. Dent Clin North Am 2005;49:533-50.
- Mealy BL, Klokkevold PR. Periodontal medicine. In: Newman MG, Takei HH, Carranza FA, editors. Carranza's Clinical Periodontology, 9th ed. Philadelphia, PA: W.B Saunders Company; 2002. p.229-44.
- Uppal RS, Bhandari R, Singh K. Association between erectile dysfunction and chronic periodontitis: A clinical study. Ind J Dent Res 2014;25:430-3.
- Li JJ, Fang CH, Hui RT. Is hypertension an inflammatory disease? Med Hypothesis 2005;64:236-40.
- Boos CJ, Lip GY. Is hypertension and inflammatory process? Curr Pharm Des 2006;12:1623-35.
- Savoia C, Schiffrin EL. Inflammation in hypertension. Curr Opin Nephrol Hypertens 2006;15:152-8.
- Li JJ. Inflammation in hypertension: Primary evidence. Chin Med J 2006;119:1215-21.
- Bautista LE, Vera LM, Arenas IA, Gamarra G. Independent association between inflammatory markers (C-reactive protein, interleukin-6 and TNF- α) and essential hypertension. J Hum Hypertens 2005;19(2):149-154.
- Shamsuddin SN, Ahmed A, Taib H, Mohamad WM. Hypertension and its association with the severity of chronic periodontitis: a preliminary study. Arch Orolfac Sci 2015;10(1):3-9.
- Langervall M, Jansson L, Bergstrom J. Systemic disorders in patients with periodontal disease. J Clinical Periodontol 2003;30(4):293-9.
- Ainamo, J.; Bay, I. Problems and proposals for recording gingivitis and plaque.

International Dental Journal 1975;25(4):229-235.

- Löe, H. The Gingival Index, the Plaque Index and the Retention Index Systems. J Periodontol 1967;38(6):610-16.
- Chobanian AV, Bakris GL, Black HR, et al; Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program Coordinating Committee: Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension 2003;42(6):1206-1252.
- Mealey BL. Influence of periodontal infections on systemic health. Periodontol 2000 1999;21:197-209.
- Mealy BL. Periodontal implications: Medically compromised patients. Ann Periodontol 1996;1:256-321.
- Zhang L, Li YF, Liang ZZ, Ba PF, Sang XH, Liu J, Abudula D, Wang WL. The association between chronic periodontitis and hypertension in rural adult Uygur residents (in Chinese). Zhonghua Xin Xue Guan Bing Za Zhi. 2011 Dec; 39(12): 1140-4.
- Zainuddin MMN, Taib H, Raja Awang RA, Hassan A, Alam MK. Systemic conditions in patients with periodontal disease. Int Med J 2013; 20(3): 363-6.
- Soory M. Periodontal disease severity and systemic diseases prevalent in a Caribbean catchment area of patients. West Indian Med J 2007; 56(2): 190-3.
- Holmlund A, Holm G, Lind L. Severity of periodontal disease and number of remaining teeth are related to the prevalence of myocardial infarction and hypertension in a study based on 4254 subjects. J Periodontol 2006; 77(7): 1173-78.
- Leong XF, Ng CY, Badiah B, Das S. Association between hypertension and periodontitis: possible mechanism. Scientific World Journal 2014;(1): 1-11.
- Angeli F, Verdecchia P, Pellegrino C. Association between periodontal disease and left ventricular mass in essential hypertension. Hypertension 2003; 41(3): 488-492.
- Volzke H, Schwahn C, Dorr M. Gender differences in the relation between number of teeth and systolic blood pressure. J Hypertens 2006; 24(7): 1257-1263.
- Volzke H, Schwahn C, Dorr M. Inverse association between number of teeth and left ventricular mass in women. J Hypertens 2007; 25(10): 2035-2043.
- Tsakos G, Sabbah W, Hingorani AD. Is periodontal inflammation associated with raised blood pressure? Evidence from a National US survey. J Hypertens 2010; 28(12): 2386-2393.
- Desvarieux M, Demmer RT, Jacobs DR. Periodontal bacteria and hypertension: the oral infections and vascular disease epidemiology study. J Hypertens 2010; 28(7):1413-1421.
- Papapanagiotou D, Nicu EA, Bizzaro S. Periodontitis is associated with platelet activation. Atherosclerosis 2009;202(2):605-611.
- Engstrom S, Gahnberg L, Högberg H, Svardsudd K. Association between high blood pressure and deep periodontal pockets: a nested case-referent study. Upsala Journal of Medical Science 2007; 112(1): 95-103.