

Original Article

Comparative study of Haematological Parameters of Anaemia in Patients with and without Chronic Periodontitis

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ABSTRACT:

Context: Anaemia and chronic periodontitis are among the most common diseases worldwide. Various studies since 20th century suggested conflicting reports regarding association between anaemia and chronic periodontitis. **Aims:** To evaluate the association between anaemia in patients with and without chronic periodontitis in Indian population. **Settings and Design:** We conducted a study where we compared haematological parameters of anaemia like number of erythrocytes, mean corpuscular volume, haemoglobin concentration, haematocrit, mean corpuscular haemoglobin, and mean corpuscular haemoglobin concentration in periodontally healthy subjects with chronic periodontitis patients. **Methods and Material:** In this cross-sectional study, 60 systemically healthy male subjects participated and patients with chronic periodontitis were included in study group and periodontally healthy subjects in control group. Periodontal parameters such as Plaque Index, Gingival Index, Gingival Bleeding Index, Periodontal Probing Depth and Clinical Attachment Loss were assessed in all participants. Radiograph was taken to confirm clinical diagnosis. Venous blood sample of 5ml were collected and sent for complete haemogram. Inter-group comparison done for clinical parameters of periodontitis and haematological parameters of anaemia. **Statistical analysis used:** Unpaired t test. **Results:** Periodontal parameters were significantly higher in study group in comparison with control group ($p < 0.05$) but haematological parameters showed no significant difference between two groups ($p > 0.05$) in the present study. **Conclusions:** Within the limits of this cross sectional study we conclude that blood parameters of anaemia are not affected by presence or absence of chronic periodontitis. This conflicting association must be further evaluated in long term study to validate any report.

Key words: Anaemia, Chronic Periodontitis, Red blood cells.

Key Messages: Association between anaemia and chronic periodontitis is subject of debate since past century as both are amongst common diseases occurring worldwide. Though many studies revealed association between two diseases, few other studies and the present study did not find blood parameters defining anaemia to be changed significantly in chronic periodontitis cases.

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INTRODUCTION:

Anaemia is a state of reduced haemoglobin (Hb) concentration, reduced number of circulating erythrocytes (RBS) in the blood, or both.¹ Globally anaemia affects approximately 24% of world population.² Iron deficiency

anaemia is the most common form of anaemia in Indian population.³ The three major causes of microcytic anaemia are iron deficiency, chronic disease and thalassemia.⁴ Anaemia in chronic disease (ACD) is the most common form of anaemia which occurs in chronic

infections, inflammatory conditions, or neoplastic disorders, and is not caused by marrow deficiencies or other diseases, but occurs despite of adequate iron stores and vitamins.^{5,6,7,8} Acute phase proteins such as C reactive protein have been shown to be elevated in patients with periodontitis.⁹ Many studies have associated periodontitis with systemic diseases.¹⁰ Various studies reported conflicting data regarding relationship between anaemia and periodontitis.¹¹ Hence we decided to study the association between anaemia and chronic periodontitis in our demographic region as both diseases are very common in Indian population.

MATERIALS AND METHODS:

A cross-sectional study was conducted on 60 males; otherwise systemically healthy subjects aged 25-55 years. Subjects for this study were selected from the outpatient Department of the Periodontology, from our Institute. Study group comprised of 30 Chronic Periodontitis patients and Control group of 30 healthy subjects without periodontitis. All patients received verbal explanation of the nature of the study, and informed written consent was obtained. The study was approved by Institutional Ethical Committee. A detailed systemic and family history was recorded. Patient diagnosed with chronic Periodontitis with pocket probing depth (PPD) ≥ 6mm in more than 30% sites & bone loss more than 50% seen in radiographs were included in the study as chronic periodontitis group. Exclusion criteria were, female patients, patients with systemic diseases, patients with history of medication or hospitalization for past 6 months, smokers, and patients who received periodontal therapy in the past 6 months. The periodontal status of all individuals was evaluated with the clinical parameters like Gingival Index (GI), Plaque Index (PI), Gingival Bleeding Index (GBI), PPD and clinical attachment level (CAL). A calibrated periodontal probe (UNC-15, Hu-Friedy, Chicago, IL, USA) was used to measure CAL on six sites of teeth (mesial, median and distal points at buccal and palatal aspects). Venous blood samples were obtained by

venipuncture in the antecubital fossa without excessive venous stasis. The blood samples were collected in test tube with EDTA and processed within 4 hours of collection in an automated haematology analyser. The numbers of RBC, mean corpuscular volume (MCV), haemoglobin concentration (Hb), haematocrit (packed cell volume), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC) were measured.

All data compiled together and statistical analysis done with SPSS version 17 software. Descriptive statistics was employed to estimate mean and SD. Unpaired t-test employed to compare the parameters between the study and control group.

RESULTS:

The sample size of this study was 60 male subjects with age range from 25 to 55 years. Mean age for Control group was 36 years and mean age for Study group was 38 years. Statistical analysis of periodontal health indices between control and test group (Table 1) shows that clinical parameters were significantly more in test group as compared to the control group (p<0.5). CAL was highly significantly more (p<0.000) in test group (3.20±0.84) than control group (0.20±0.40), GBI and PPD was significantly greater (p<0.000) in test group (63.32±7.15 and 5.30±0.83 respectively) as compared to control group (33.57±8.36 and 1.86±0.50 respectively). GI was high (p< 0.002) in test group (1.68±0.38) in comparison to control (1.40±0.25). PI was significant (p<0.028) in test (1.81±0.40) in oppose to control (1.59±0.36).

Haematological parameter on the other hand did not show any significant difference (p>0.05) between test group and control group (Table 2). The test group in comparison to control group showed a slightly lesser HB levels (p<0.071), low PCV (p<0.11), lower MCH (p<0.16) and lower RBC count (p<0.23) but MCHC (p<0.40) and MCV (p<0.90) in fact were slightly higher in test group as compared to control, all of which were statistically insignificant.

Table 1- Clinical parameters in Control and Test Group (Original)

Variable	Control		Test		Control v/s Test	
	Mean	SD	Mean	SD	*t value	P value
PI	1.59	0.36	1.81	0.40	-2.26 [†]	0.028 [‡]
GI	1.40	0.25	1.68	0.38	-3.33 [†]	0.002 [‡]
GBI	33.57	8.36	63.32	7.15	-14.81 [†]	0.000 [‡]
CAL	0.20	0.40	3.20	0.84	-3.00 [†]	0.000 [‡]
PD	1.86	0.50	5.30	0.83	-3.40 [†]	0.000 [‡]

* Unpaired t test

†(Negative sign)-indicates increased levels in test group

‡P < 0.05, Significant

Table 2- Haematological parameters in Control and Test Group (Original)

Variable	Control		Test		Mean diff.	Control v/s Test	
	Mean	SD	Mean	SD		t value*	P value
Hb	14.36	1.15	13.74	1.43	0.62	1.84	0.071 [‡]
RBC	4.95	0.38	4.81	0.52	0.14	1.22	0.23 [‡]
MCV	88.47	7.38	88.73	8.22	-0.27 [†]	0.13	0.90 [‡]
MCH	29.83	2.66	28.79	3.03	1.04	1.42	0.16 [‡]
MCHC	32.17	0.92	32.43	1.37	-0.25 [†]	0.84	0.40 [‡]
PCV	44.06	3.10	42.46	4.40	1.60	1.63	0.11 [‡]

* Unpaired t test

†(Negative sign)-indicates increased levels in test group

‡P > 0.05, not significant

DISCUSSION:

Increased in production of cytokines like tumour necrosis factor (TNF), interleukin (IL)-1 and interferon which mediates immune and inflammatory response is a characteristic findings of disorders associated with ACD.¹² These cytokines are responsible for all pathological processes of ACD including shortened red cell survival, blunted erythropoietin response to anaemia, impaired erythroid colony formation in response to erythropoietin and abnormal mobilization of reticuloendothelial iron storage.¹³ Chronic periodontitis is the most common form of periodontitis. Various studies in the past suggested that pathogenic bacteria and/or their products can stimulate cells presents in the periodontal tissues like fibroblasts, keratinocytes and macrophages to produce various inflammatory cytokines such as TNF- α , prostaglandin E2, IL (IL-1 β , IL-6 and IL-12), granulocyte colony stimulating factor (G-CSF) and chemokines. These chemokines such as IL-8 can regulate T-cell function and induce secretion of interferon-inducible protein (IP-10), and macrophages inflammatory proteins (MIP)-10 that are relevant to inflammatory process in periodontitis.^{14, 15} Elevation in the cytokines and chemokines by gingival connective tissues in chronic periodontitis lesion can results in the increase levels of these mediators in the blood circulation, where they can induce systemic effects.^{16, 17} Thus there is strong hypothesis regarding correlation of ACD and periodontitis.

Association of anaemia and periodontitis was explained by various studies since past century. Goldstein,¹⁸ Siegel,¹⁹ Lianson et al,²⁰ and Chawla et al²¹ were among the earliest to study the correlation between anaemia and periodontitis. Except one study,¹⁹ all others^{18,20, 21} report suggested anaemia as a cause of destructive periodontitis and not the consequences of it. Siegel¹⁹ in 1945 reported a depression in number of erythrocytes apparently secondary to the presence of periodontal disease. He even reported that periodontal therapy resulted in the resolution of anaemia. Hutter et al²² evaluated blood parameters in chronic periodontitis patients and found that periodontitis patients have lower haematocrit, lower level of Hb, and lower number of RBC and termed it as ACD. However results of present study is in contrast with all above studies and consistent with studies of Wakai et al²³ in which he did not observe

any relationship between increased Community Periodontal Index of Treatment Need (CPITN) scores and Hb levels.

In present study we eliminated smokers and patients with habit of tobacco chewing as they may add up confounding factor. Erademir et al²⁴ reported that smokers with chronic periodontitis had a lower numbers of RBCs, lower level of Hb, lower haematocrit and iron as compare to the non-smoker chronic periodontitis patients. In India, anaemia is more prevalent in females because of poor nutrition, menstrual blood loss, high incidences of tropical and intestinal infections and other miscellaneous causes.²⁵ Hormonal imbalances due to puberty, various stages of reproductive cycle and toward menopause can lead to altered host immune response.²⁵ Hence to avoid bias, we included only male patients in our study.

In present cross sectional study we compared clinical periodontal parameters and blood samples of subjects with chronic periodontitis (test group) and without periodontitis (control group). Statistical result revealed that test group showed significantly high clinical parameter (PI, GI, GBI, CAL, PPD) as compared to control group is an evidence of presence of periodontitis in test group. In contrast there was no significant difference in haematological parameters between test and control group suggested that presence of chronic periodontitis have not affected blood parameters related to anaemia. This result is contradictory to the results of the earlier studies¹⁸⁻²² which reported anaemia associated with periodontitis.

Hutter²² detected ACD in patients with chronic periodontitis was in fact termed as a slight form of anaemia by loss²⁶, as chronic periodontitis is a mild inflammatory condition²⁵. Thus there is always possibility of the presence or absence of this condition depending upon the amount of inflammation present and host response to the inflammation.¹¹ This is in support of present study in which although clinically chronic periodontitis was evident on test group as compare to control group, there was no significant difference in haematological parameters in both groups.

Results of our study are consistent with study of Prakash et al¹¹ in which author reported no significant difference in haematological and biochemical parameter of anaemia in control and study group and these

parameters were not affected by severity of chronic periodontitis. They also concluded that the parameters were not significantly different between males and females of both test and control group. Jenabian et al²⁷ attributed the results of Prakash et al¹¹ to the facts that they involved both gender and the number of subjects in control and test group was not equal. In our study only male subjects was included in equal numbers (30 each) for both (test and control) groups.

Enhos et al¹ rejected anaemia as one of the risk factor of periodontal disease but reported increase in Hb after phase 1 periodontal therapy²⁷. Alijohani^[12] reported increase in haemoglobin level with increase in severity of periodontitis. Zieblots et al²⁸ reported the correlation between increased Hb and haematocrit levels and periodontitis. They identified periodontal inflammation as a cause of increased blood flow and haematological parameters²⁷. Many other studies have shown difference in correlation between various haematological parameters (Hb, RBC, MCH, MCHC, and PCV etc) and periodontitis.

Therefore from the result of our study the hypothesis of association between haematological parameters of anaemia and periodontitis is insignificant. The limitations of this study are that it is cross sectional study and sample size was limited. More longitudinal studies need to be conducted with larger sample size to further explore the relation between anaemia and periodontitis.

CONCLUSION

As per present cross sectional study, hematologic parameters of anaemia are not affected by presence or absence of chronic periodontitis in systemically healthy subjects. Various studies in the past have inconsistent results about correlation between anaemia and periodontitis. Thus the hypothesis of ACD can be caused by periodontitis has to be used with prudence and need to be investigated further.

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