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COMPARATIVE EVALUATION OF ERYTHROCYTE PARAMETERS AMONG CHRONIC PERIODONTITIS PATIENTS - A CROSS SECTIONAL STUDY

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Abstract:

Background: Periodontitis is a multifactorial, chronic inflammatory condition that affects theoral cavity and has been linked to anaemia. Anaemia of chronic disease is the second most prevalent serious health condition that affects people of all sexes and ages. Anaemia is considered as one of the etiological factors of periodontitis and a chronic periodontitis can be as risk factor for anaemia. The aim of the present was to evaluate erythrocyte parameters among chronic periodontitis patients.

Method: Total200 subjects were included in the study. Group I: 50 systemically healthy males with healthy periodontium, Group II- 50 Systemically healthy males with chronic periodontitis, Group III: 50 Systemically healthy females with healthy periodontium and Group IV: 50 Systemically healthy females with chronic periodontitis. Erythrocyte parameters (HCT/PCV, MCV, MCH, and MCHC) and ESR were evaluated from venous blood samples.

Results: Erythrocyte parameters were found to be decreased among both male and female chronic periodontitis patients compared to their periodontally subjects. The level of significance was set at $p \leq 0.005$.

Conclusion: It can be concluded based on the results that, like any other chronic condition, chronic periodontitis can also lead to anemia.

Key words: Periodontitis, Erythrocyte parameters, Packed cell volume, Anemia, Risk Factor

INTRODUCTION

Chronic periodontitis is an inflammatory disease of the supporting structures of the teeth caused by specific microorganisms in a susceptible host. The plethora of bacterial challenges that are typical of chronic periodontitis disease poses a threat to the integrity of the sulcular epithelium which acts as a protective barrier, prevents entry of microorganisms and other irritants into the systemic circulation. This breach of the sulcular epithelium acts as a gateway to the bacterial irritants to enter the connective tissue and thus into the systemic circulation. The host-microbial interaction in periodontitis leads to ulceration of sulcular epithelium.

Bacteraemia has been observed in patients with periodontitis and has been directly related to the severity of inflammation. The subgingival microbiota in patients with periodontitis poses a significant and persistent Gram-negative bacterial challenge to the host.[1]The host response in turn activates C-reactive proteins, interleukin-6 (IL-6) and tumor necrosis factor- α (TNF-α) all of which can depress erythropoietin production leading to the development of anaemia.This suggests a possible influence of periodontitis on systemic status of an individual. Studies have associated periodontitis with atherosclerosis, cardiovascular diseases, and stroke. These studies indicate that periodontitis leads to low-grade systemic inflammation. The most commonly observed form of anemia in clinical medicine is anemia of chronic disease. It is defined as anemia occurring in chronic infections, inflammatory conditions, or a neoplastic disorder, which is not caused by marrow deficiencies or other diseases, and occurring despite the presence of adequate iron stores and vitamins.[2] Recent years have seen a growing interest in periodontal medicine which focuses on the relationship between periodontal and systemic health. This means a two-way relationship exists in which the periodontal disease in an individual may have an effect on his/her systemic health and vice versa. However, debate still exists on the nature and degree to which this association exists. With the clear distinction between sex and gender, gender oral health disparities have been explained by socioeconomic factors, cultural attitudes as well as access to preventive and regular care.[3] Economic inequality and hardship for women have resulted in limited access to oral care. As a result, gender emerged as a complex socioeconomic and behavioural factor influencing oral health outcomes. Taken together, as disease phenotypic presentation is a multifactorial product of biology, behaviour and the environment, sex dimorphism in immunity as well as gender socio-behavioural construct might play a role in the above mode.The present study aims to evaluate the erythrocyte parameters among patients with chronic periodontitis.

MATERIAL AND METHODS

The present cross-sectional study was carried out in an institutional outpatient department of periodontology, Rama Dental College Hospital and Research Centre, Kanpur. An ethical clearance was obtained from the institutional ethical committee.A total of 200 systemically healthy male and female patients of equal ratio, within a age group of 40 to 60 years. The patients were grouped under three categories: -

Group 1 consisting of Systemically healthy males with clinically healthy periodontium.

Group 2 consisting of Systemically healthy males with generalized severe chronic periodontitis

Group 3 consisting of Systemically healthy females with clinically healthy periodontium.

Group 4 consisting of Systemically healthy females with generalized severe chronic periodontitis

All the groups consisting of equal patients each respectively.A detailed systemic and family history was recorded. The inclusion criteria were:1. Systemically healthy both male and female subjects.2. Generalized chronic periodontitis patients (severe). The exclusion criteria were:1. Patients with history of any systemic disease (diabetes, kidney disease, cancer or fungal or respiratory infections.2. Patients with history of hospitalization or intake of medications in the last 6 months.3. Patients with a current or past habit of tobacco smoking or chewing.4. Patients with a previous history of periodontal therapy. 5. Pregnant or lactating mothers.6. Having < 16 teeth in the mouth.

Full-mouth examination was conducted for each participant, and detailed gingival and periodontal findings were recorded by a single independent trained dental professional (kappa value: 0.91). OHI-s using shepherd's hook explorer, Gingival Index, PPDs and CALs were all marked using a UNC-15 periodontal probe as shown in Figure 1.

Figure 1: Periodontal Examination   Figure 2: Blood drawn from brachial plexus of veins

HEMATOLOGICAL PARAMETERS

After complete recording of gingival findings, venous blood samples were obtained from brachial plexus of veins of each participant by a nursing assistant as shown in Figure 2.

Two millilitres of blood were obtained by venipuncturefrom the antecubital fossa under complete aseptic measures and immediately transported to the Laboratory.Centrifugation of blood was done as shown in Figure 3.

Figure 3: Blood centrifugation done

Figure 4: Erythrocytic parameters estimated by auto analyser

Haematocrit/Packed Cell Volume (HCT/PCV), Mean corpuscular volume (MCV), MeanCorpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) were analysed on a fully automated hematologic analyser as shown in Figure 4. And Erythrocyte sedimentation rate (ESR) was estimated by Wintrobe's method.

STATISTICAL ANALYSIS

Statistical analyses using statistical package SPSS 23.0 (SPSS Inc., Chicago, IL), with the level of significance was set at $p \leq 0.005$. Mean and standard deviation of all the parameters were calculated for both the systemically healthy males and females and the subsequent systemically healthy male and females with chronic periodontitis. Descriptive statistical analysis and ANOVA test was done to compare the mean ± standard deviation across groups.

RESULTS

The comparative analysis of erythrocyte parameters (HCT/PCV, MCV, MCH, MCHC, ESR) across the four groups emphasizing the significant difference in erythrocyte parameters between healthy individuals and those with chronic periodontitis.

| Parameters	Healthy Male	Chronic Periodontitis Male	Healthy Female	Chronic Periodontitis Female
	Mean Std Dev	Mean Std Dev	Mean Std Dev	Mean Std Dev
HCT/PCV	49.36 ± 0.25	37.64 ± 0.29	38.99± 0.35	30.21 ± 0.51
MCV	95.77 ±0.31	81.39 ± 0.31	86.44± 0. 43	75.87 ± 0.35
MCH	30.84 ± 0.28	25.65 ± 0.35	29.17 ±0.45	22.89 ± 0.47
MCHC	31.31 ± 0.33	28.21 ± 0.38	31.70 ± 0.37	25.09 ± 0.49
ESR	5.31 ± 0.32	8.45 ± 0.41	5.67 ± 0.45	8.56 ± 0.51

Table 1:Mean and Std deviation of erythrocyte parameters (HCT/PCV, MCV, MCH, MCHC and ESR)
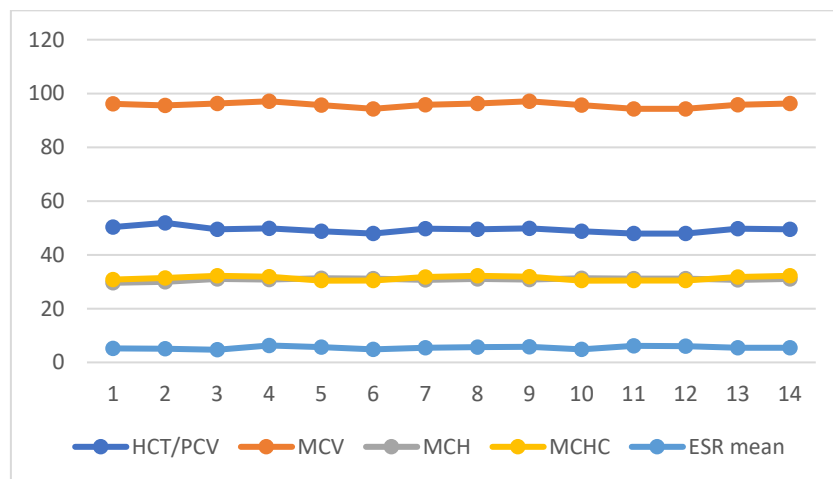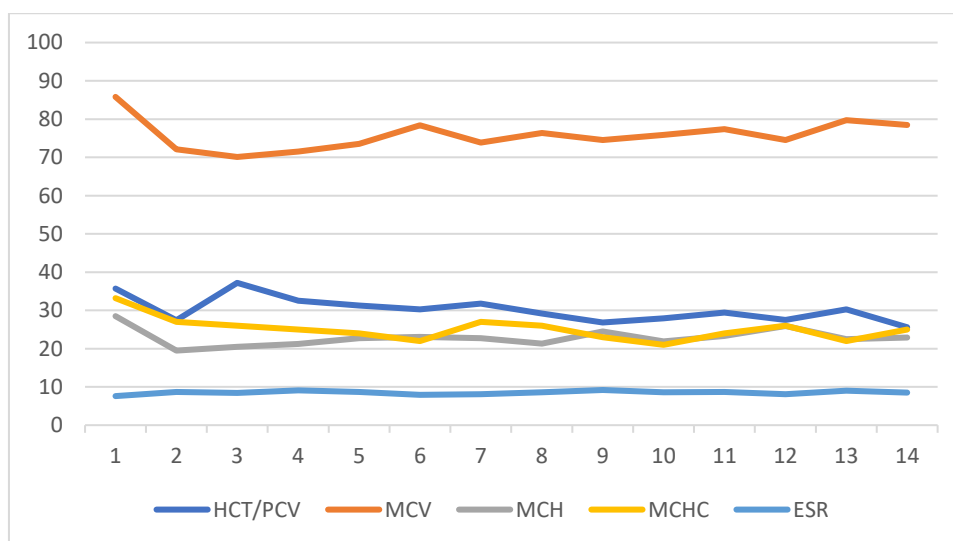

Graph 1: Descriptive analysis of erythrocyte parameters in systemically healthy male (Group I)
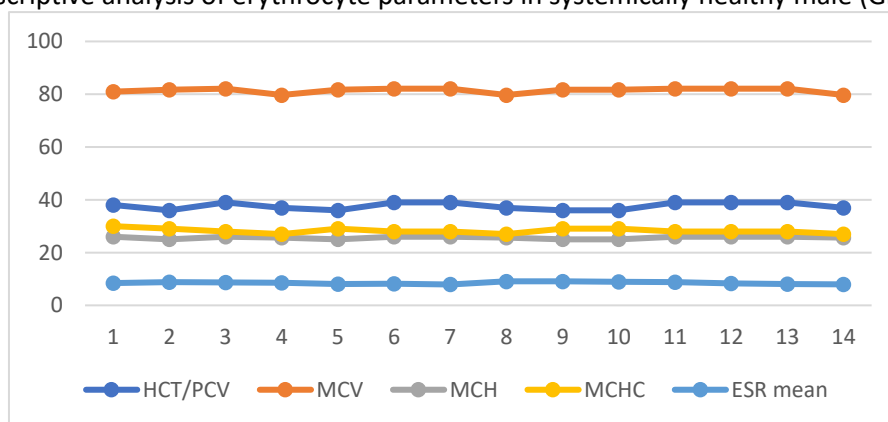
Graph 2: Descriptive analysis of erythrocyte parameters in systemically healthy male with chronic periodontitis (Group II)
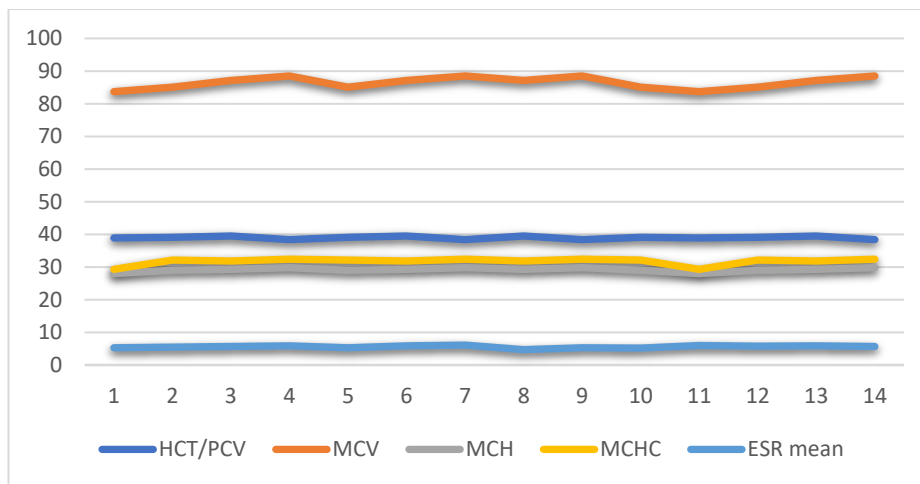
Graph 3: Descriptive analysis of erythrocyte parameters in systemically healthy female (Group III)

In table 1 and Graph 1-4, the mean values for HCT/PCV, MCV, MCH, MCHC and ESR were are consistently lower in both 37.64%, 81.39 fL, 25.65 pg, 28.21 g/dl males and 30.21 %, 75.87 fL, 22.89 pg, 25.09 g/dl females respectively with chronic periodontitis compared to their healthy 49.36 %, 95.77 fL, 30.84 pg, 31.31g/dl male and 38.99%, 86.44 fL, 29.17pg, 31.70 g/dl female counterparts. Whereas; the ESR value in both healthy males i.e 5.31 mm/hr and females i.e 5.67 mm/hr were found to be decreased as compared to males i.e 8.45 mm/hr and females i.e 8.56 mm/hr with chronic periodontitis. This finding was consistent for both genders, reinforcing the hypothesis that chronic periodontitis can affect blood parameters lower erythrocyte value, potentially leading to anemia. The p-values for each erythrocyte parameters between healthy individuals and those with chronic periodontitis were statistically significant ($p \leq 0.05$).

Graph 4: Descriptive analysis of erythrocyte parameters in systemically healthy female with chronic periodontitis (Group IV)

Parameter	Male (p-value)	Female (p-value)
HCT/PCV	0.006	0.003
MCV	0.005	0.001
MCH	0.001	0.002
MCHC	0.002	0.003

Table 2: Statistical significance (t-test p-values)

In table 2, the p-values obtained from the t-test for each erythrocyte parameter between healthy individuals and those with chronic periodontitis are extremely low (far below the 0.05 threshold), indicating a statistically significant difference. This means that the differences observed in the erythrocyte parameters are unliked to be due to chance.

DISCUSSION

Anemia is defined as a decrease in the human Hb concentration below the normally acceptable levels and is one of the most commonly encountered health problems around the globe, especially in the developing countries. The association of anaemia and periodontitis hasbeen explored since the early 20th century. Earlier literatures have suggested anaemia to be a cause, and nota consequence, of destructive periodontitis. Lainson *et al.*[4] was one of the first authors to implicate anaemia as a systemic cause of periodontitis. Chawla *et al.*[5] suggested that anemia is an important factor in the etiology or pathogenesis of periodontal disease.

The present study shows a decrease mean value of MCV in chronic periodontitis males 81.39 fL and females 75.87 fL compared to healthy male and females 95.77 fL and 86.44 fL. Similarly, low MCH found in males and females were 25.65 pg, 22.89 pg and MCHC in males and females were 28.21 g/dl and 25.09 values in the test as compared to the control groups 30.84 pg and 31.31 g/dl in males and 29.17 pg and 31.70 g/dl in females respectively. This was in accordance Hutter *et al.*[6] 2001 reported that chronic periodontitis patients have a definite lower count of MCV, MCH, MCHC parameters in males i.e 88.0 fL, 1.83 pg, 20.8 g/dl and females i.e., 89.9fL, 1.88 pg, 20.9 g/dl respectively when compared to healthy controls. Siegel et al. also reported a depression number of erythrocytes apparently secondary to the presence of periodontal disease. Chronic periodontitis affects erythrocyte proliferation and differentiation, leading to tissue destruction and the release of pro-inflammatory cytokines like IL-1α, IL-6, and TNF-α, which suppress erythropoiesis, resulting in anemia.

In current study ESR showed a highly significant P≤0.05 relationship in patients with periodontitis, when compared to individuals with clinically healthy gingiva. The mean ESR levels for periodontitis patients were higher while compared to healthy individuals. Similar results were shown in studies conducted by Prakash *et al.*[7] in 2012. In test group ESR values had been increased, suggesting of chronic infection in periodontitis patients. Catwright[8] postulated that shortened erythrocyte survival, failure of bone marrow to increase RBC production to compensate for this increase demand, impaired release of iron from the reticuloendothelial system, all of which can lead to anaemia of chronic diseases.

Periodontitis is also a chronic inflammatory disease that leads to elevation of cytokines. The severity ofanemia may depend on the elevation of proinflammatory cytokines. The change in hemoglobin and RBCvalues in the present study is statistically significant but the difference is not as striking as observed in anemia caused by other inflammatory conditions, such as rheumatoid arthritis, neoplastic conditions, and fungal or parasitic infections. This may be explained by the fact that chronic periodontitis is amilder inflammatory condition compared to other systemic infections or conditions.

CONCLUSION

Systemic infections, particularly those that are persistent, directly impact a person's overall health and wellbeing. Our study strongly suggests that chronic periodontitis is associated with lower erythrocyte parameters, indicating a potential link to anaemia.This finding is consistent for both genders, reinforcing the hypothesis that chronic periodontitis can affect blood parameters, potentially leading to anaemia and provide robust evidence supporting the relationship between periodontitis and changes in erythrocytic parameters.

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