

## DETERMINATION OF ERYTHROCYTE PARAMETERS IN CHRONIC PERIODONTITIS PATIENTS

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### Abstract

**Objective:** Limited research has been reported on the relationship between periodontal status and erythrocyte parameters. Anemia of chronic diseases is one of the most common forms of anemia. It occurs due to chronic infections, inflammatory conditions or neoplastic disorders which are not due to marrow deficiencies or other diseases. Periodontitis is one of the most prevalent chronic inflammatory diseases in humans. This study is aimed at finding the relation between erythrocyte parameters and chronic periodontitis. **Materials and methods:** A total of 50 patients were selected for the study. The patients chosen for study had at least 30% or more of the teeth having greater than or equal to 4 mm probing depth. Clinical parameters like gingival index (GI), plaque index (PI), probing pocket depth (PD) and clinical attachment levels (CAL) were recorded for all the patients and haematological variables were determined from peripheral blood samples. The results were analysed statistically. **Results:** The mean values of haemoglobin (Hb) and red blood cell indices were significantly lower, while the value of ESR was significantly higher in test group as compared to control group, suggesting a mild anemia. **Conclusion :** A positive relationship was observed between the haematological parameters and the severity of the chronic periodontal disease, suggesting that like other chronic conditions, periodontitis, may tend towards anemia.

**Key Words :** Anemia, Chronic Periodontitis, Erythrocyte Sedimentation Rate (ESR), Hemoglobin level (Hb), Red blood cell indices.

### INTRODUCTION

Periodontitis is an inflammatory disease of the supporting tissues of the tooth caused by specific microorganisms in a susceptible host. Just as the periodontal tissues mount an immune inflammatory response to bacteria and their products, systemic challenges with these agents

also induce a major vascular response.(1) Chronic periodontitis is the most common form of periodontal disease, which progresses relatively slowly and is more common in adults.(2) It is, therefore, speculated that periodontitis results in low-grade systemic

inflammation, which may cause lower number of erythrocytes and, consequently, lower hemoglobin (Hb) concentration. However, conflicting results have been reported regarding the association of periodontal disease and anemia.

Periodontitis is a multifactorial disease with microbial dental plaque as the initiator of periodontal disease. Periodontitis being a common chronic oral inflammatory disease, is known to have systemic effects and can lead to anemia.(4)

Anemia of chronic disease (ACD) is the second most prevalent anemia after iron deficiency anemia, and occurs in patients with acute or chronic immune activation. Thus, the condition has been termed “anemia of inflammation.”(3) It is defined as anemia occurring in chronic infections, inflammatory conditions or neoplastic disorders that are not due to marrow deficiencies or other diseases, and occurring despite presence of adequate iron stores and vitamins. Most common causes of anemia of chronic disease are chronic renal disease, rheumatoid arthritis, chronic obstructive pulmonary disease. A characteristic finding of the disorders associated with the Anemia of Chronic Disease(ACD) was the increased production of cytokines that mediate the immune or inflammatory response; such as tumor necrosis factor, interleukin-1 and the interferon.(5)

The purpose of the present clinical trial was to compare the haematological parameters : Hemoglobin (Hb), Erythrocyte sedimentation rate (ESR) in patients with moderate to severe chronic periodontitis with that of periodontally healthy subjects, and thereby evaluating the

possible association between chronic periodontitis and anemia.

## MATERIALS AND METHODS

It was a clinical interventional study in which the patients were informed about the study and written consent was obtained. 50 patients within the age group of 20-40 years were selected visiting the Department of Periodontology and Oral Implantology. Mahatma Gandhi Dental college and Department of Clinical Biochemistry, Mahatma Gandhi medical college and Hospital, Jaipur(Rajasthan). An ethical clearance was obtained for the study from the ethical committee, Mahatma Gandhi dental college, Jaipur.

The criteria for inclusion were 1) presence of at least 20 teeth, 2) no history of antibiotic intake for the last 3 months prior and during the course of the study 3) no history of any minor or major trauma, any oral or general surgical procedure, which could have resulted in blood loss, 4) no history of any periodontal treatment at least 6 months before for the commencement of the study, 5) no history of blood transfusion and / or donation minimum 3 months prior to study, 6) no history of use of vitamin or iron supplementation within the previous 3 months.

According to the clinical examination, disease was divided into mild, moderate and severe periodontitis based on the following criteria.

Mild Periodontitis: >30% of teeth with 1-2 mm of clinical attachment loss.

Moderate Periodontitis: >30% of teeth with 3-4 mm of clinical attachment loss.

Severe Periodontitis: >30 % of teeth with 5mm or more of clinical attachment loss.

Orthopantomograph was taken for all the patients.

The study subjects were categorized into 2 groups: Group A and Group B with 50 (25 males and 25 females) individuals each. Group A included subjects with moderate to severe periodontitis (test group) and Group B included periodontally healthy subjects (control group).

A full mouth periodontal examination was conducted for all the subjects using the following clinical parameters:

Gingival Index - Loe and Silness, 1963

Probing Pocket Depth – using William's Periodontal Probe

Clinical Attachment Level - using William's Periodontal Probe.

### Collection of Blood Sample

After recording the clinical parameters, 5 ml of venous blood was drawn from the ante cubital fossa under aseptic conditions. The drawn blood was transferred immediately to EDTA containing vacutainers to be transported to the Medical Laboratory. The estimation of the following hematological parameters was done.

-Hemoglobin level (Hb),

-Erythrocyte Sedimentation Rate(ESR)

### Statistical Analysis:

The data so obtained was compiled and analysed using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 15.0 for windows). Mean and Standard deviation for all parameters were calculated. The statistical significance of differences in independent

variables for the intergroup measurements over time were tested according to Student t test (two tailed, independent). A two tailed Probability value (p-value) < 0.05 was considered as significant. P-value of > 0.05 was considered as non-significant.

### RESULTS

The mean value of hemoglobin (Hb) in males was 10.52 in Group A (test) as compared to 12.92 in Group B (control), whereas in females, the mean value of Hb was 9.25 in Group A (test) as compared to 10.56 in Group B (control). The difference in mean between test and control groups in both males and females was statistically significant when compared ( $p < 0.05$ ). Also, the mean value of ESR was significantly higher in Group A (males: 24.07, females: 35.00) as compared to Group B (males: 5.5, females: 8.6).

### DISCUSSION

Periodontal disease has a proven relationship with several systemic conditions like cardiovascular diseases, Diabetes mellitus, adverse pregnancy outcomes, obesity and stroke. One of the lesser-documented association has been the inter relationship between periodontal disease and anemia.

Anemia of chronic disease is an immune driven process in which cytokines result in decreased erythropoietin production, impaired proliferation of erythroid progenitor cells and disturbed iron homeostasis.(4) This normocytic and normochromic anemia has been described in many chronic diseases like rheumatoid arthritis, renal failure, bacterial and parasitic infections,

chronic periodontitis, etc. The present study was undertaken to study the possible association between the hematological parameters and the severity of periodontitis. The current study excluded smokers, (6) patients on antibiotics and with recent history of blood loss, systemic conditions such as cardiovascular disease, metabolic syndrome and diabetes, as these characteristics can act as possible confounding factors that could alter the haematological parameters. (7)

Clinical parameters viz. gingival index, probing pocket depth and relative attachment level were included in the study for the assessment of the inflammatory state of the gingival tissues and the severity of the periodontal disease. The hematological parameters viz. Hemoglobin (Hb), erythrocyte sedimentation rate (ESR), were selected for evaluation, as these are indicative of the anemic state of the patient and also the type of anemia based on morphology of the cell.

In the current study, both males and females were included. The possible reason for this could be hormonal changes encountered in females during pregnancy, lactation, menstrual cycle, reproduction etc. (8)

In the present study both test male and female groups showed a significant lower value of haemoglobin when compared to control. So, periodontitis needs to be considered as a chronic disease which may cause lower number of erythrocytes and consequently lower hemoglobin levels. The pathogenesis for the current findings is most likely similar as reported for rheumatoid arthritis, i.e. downregulation of the erythropoiesis in bone marrow by

proinflammatory cytokines could be responsible for decreased blood counts.

According to Gokhale et al, (9) Naik et al, (2) and Pradeep et al. (1) Periodontitis patients have elevated levels of acute phase proteins, interleukin (IL)-1, IL-6, and tumor necrosis factor (TNF). These inflammatory mediators are shown to suppress mature erythroid progenitors (10) and inhibit in vitro colony formation by erythroid burst-forming units and erythroid colony-forming units from normal human marrow. (11,12,13) Inhibition of erythropoietin, the hormone responsible for erythropoiesis, was also seen (14) that leads to decrease in RBC count.

Smokers were also excluded from the study. Various studies (15,16) have evaluated the PPD, CAL, PI, GI, and radiographic bone measurements of smokers and non-smokers, and found a positive correlation between smoking and these clinical parameters. Studies also indicate elevated concentrations of TNF and IL-6 as a consequence of smoking. (17)

Systemic circulation of cytokines originating from local inflammation suppresses erythropoiesis. (4) In test group, ESR were seen to be increased, suggesting of chronic infection, as in anemia, red cell aggregates sediment faster, thus the severity of anemia correlates with the ESR. The ESR is a traditional parameter in medicine of any given inflammatory process. It provides a multi-factorial measure of the systemic response to an infectious or inflammatory disease, i.e. a change in the plasma concentration of several inflammation related proteins, that affect the formation of rouleaux by

erythrocytes, and which subsequently precipitate (sedimentation). However, this parameter of inflammation seems of limited use as diagnostic tool in periodontitis to measure the systemic involvement. (4),(18)

The results of the present study were in agreement with those conducted by Hutter et al.(4) and Thomas et al.(19) which also reported lower numbers of erythrocytes, lower hemoglobin levels and higher erythrocyte sedimentation rates in periodontitis patients when compared to healthy controls. Agarwal et al.(20) (2009) also demonstrated a significant improvement in haemoglobin values and erythrocyte counts after periodontal treatment, including surgery in patients with generalized chronic periodontitis with anemia. However, Wakai et al (22) (1999) and Aljohani H (21) (2010) failed to show any association between hemoglobin levels and periodontal status.

Within the limitations of the present study, it can be stated that chronic periodontal diseases are associated with alterations in the haematological parameters viz. hemoglobin, erythrocyte sedimentation rate and red cell indices. These findings may be related to the elevated levels of pro-inflammatory cytokines in plasma of periodontitis patients suppressing erythropoiesis. The present study has paved the path for future studies, with a larger study population for a longer period of time to further validate the association between periodontal disease and anemia

## CONCLUSION

A positive relationship was observed between the haematological parameters viz. Hb, ESR, and

the severity of the chronic periodontal disease, suggesting that like other chronic conditions, periodontitis may tend towards anemia.

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**Ethical approval:** The study was approved by the institutional ethics committee

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