

Anaemia of Chronic Disease and Periodontitis

Rudrik Pandya, Shilpi Shah*, Juhi Rawal, Riya Dave, Saket Rajput, Shivani Sonaiya

Department of Periodontology, Ahmedabad Dental College, Ahmedabad, Gujarat, India.

Abstract

Aim: This study aims to evaluate the relation between hemoglobin (Hb) and periodontal disease by estimation of blood parameters. **Materials and Methods:** One hundred and fifty patients including only males aged 21–60 years who visited the Outpatient Department of Periodontology, Ahmedabad Dental College and Hospital were included. A total of 50 healthy controls (gingival index 0–1), 50 chronic gingivitis patients (gingival index Loe and Silness criteria 2–3), and 50 chronic periodontitis patients (30% or more sites having ≥ 5 mm probing depth and ≥ 2 mm CAL) were selected for the study. **Results:** In the healthy group, 22 subjects (44%) have Hb values below the reference range. In the gingivitis group, 26 subjects (52%) have Hb values below the reference range. In the periodontitis group, 12 subjects (24%) have Hb values below the reference range. In the Healthy group, 12 subjects (24%) have mean corpuscular volume (MCV) values below the reference range. In the Gingivitis group, 24 subjects (68%) have MCV values below the reference range. In the Periodontitis group, 37 subjects (74%) have MCV values below the reference range. In the Healthy group, 33 subjects (66%) have mean corpuscular Hb (MCH) values below the reference range. In the Gingivitis group, 34 subjects (68%) have MCH values below the reference range. In the Periodontitis group, 39 subjects (78%) have MCH values below the reference range. **Conclusion:** This study gives an idea about the relationship between periodontal disease and the presence of anemia by closely evaluating a range of blood parameters. The findings show a significant positive association between periodontitis and anemia, evidenced by decreased Hb levels, MCV values. The study also shows the distribution of oral health conditions across different age groups, revealing trends of higher prevalence of gingivitis among young people and chronic periodontitis among older individuals. The results exhibited a convincing positive association between these two conditions, primarily attributed to the decrease in Hb levels.

Keywords: Anemia, Gingivitis, Hemoglobin, Periodontitis etc.

INTRODUCTION

Periodontitis is an inflammatory condition affecting the supportive tissues of the teeth and is triggered by specific microorganisms in individuals who are susceptible to the disease. The primary culprits responsible for initiating periodontitis are Gram-negative anaerobic bacteria. Similar to how the periodontal tissues react with an immune inflammatory response to bacteria also leads to a significant vascular reaction. This vascular response can influence the overall health of an individual beyond just the oral cavity, emphasizing the potential systemic impact of periodontitis.^[1]

Periodontitis is characterized by several key symptoms, including redness and swelling of the gums, gingival bleeding, suppuration (pus formation), periodontal pockets, and the loss of alveolar bone, which may eventually lead to tooth loss.^[2] Diagnosing periodontitis can be achieved through different methods. A clinical examination involves using a periodontal probe of the gums and assesses the extent of inflammation and pocket formation. In addition, radiographic examination is employed to evaluate the patient's X-rays, enabling the

dentist to determine the amount of alveolar bone loss around the affected teeth. These diagnostic approaches are crucial in identifying and managing periodontitis effectively.^[2]

Anemia of chronic disease (ACD) is a type of anemia that arises in the context of chronic inflammatory conditions. Unlike anemia caused by bone marrow deficiencies or other diseases, ACD occurs even when there is sufficient iron stored in the body.^[3] ACD develops in individuals with acute or chronic immune activation, and it is often referred to as “anemia of inflammation (AI).”^[4]

Clinical studies have reported ACD to be one of the most frequently observed forms of anemia in medical practice. Typically, ACD presents as mild-to-moderate normochromic/

Address for correspondence: Dr. Shilpi Shah,
Department of Periodontology, Ahmedabad Dental College,
Ahmedabad, Gujarat, India.
Email: smilecostsnothing@gmail.com

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normocytic anemia. ACD usually develops after a month or two of active disease.^[4] Early reports suggested that anemia might be a cause, rather than a consequence, of destructive periodontitis. This is thought to be influenced by certain cytokines produced during periodontal inflammation, which can suppress erythropoietin (Epo) production, leading to the development of anemia.^[5]

Periodontitis is known to induce a low-grade systemic inflammation, which can result in a reduced number of erythrocytes red blood cells (RBCs) and subsequently lower hemoglobin (Hb) concentration. Evidence supports the presence of ACD in individuals with chronic periodontitis. Although the underlying causes of both diseases are different, the long-standing chronic inflammation associated with periodontitis can contribute to the development of anemia.^[5]

This study wants to show a comprehensive evaluation of blood parameters in individuals with periodontal disease to detect potential signs of anemia. By closely examining relevant blood markers, including Hb levels, RBC count, hematocrit, and other indicators of anemia, the research aims to uncover any possible association between periodontal disease and the presence of anemia.

The study aims to evaluate the relation between Hb and periodontal disease by estimation of blood parameters.

The objective of the study is

- To investigate whether patients with periodontal disease show signs of anemia.



MATERIALS AND METHODS

One hundred and fifty patients including only males aged 0–80 years who visited the Outpatient Department of Periodontology, Ahmedabad Dental College and Hospital were included. A total of 50 healthy controls (gingival index 0–1), 50 chronic gingivitis patients (gingival index Loe and Silness criteria 2–3), and 50 chronic periodontitis patients (30% or more of the sites examined having ≥ 5 mm probing depth and ≥ 2 mm CAL) were selected for the study.

Inclusion criteria

- Patients are willing to sign the consent form
- Patients within the age group of 20–60 years
- Systemically healthy patients, healthy controls with gingival index Loe and Silness criteria 0–1 as Group 1
- Patients diagnosed with chronic generalized gingivitis with gingival index Loe and Silness criteria 2–3 as Group 2

- Patients diagnosed with generalized chronic periodontitis (30% or more of the sites examined having ≥ 5 mm probing depth and ≥ 2 mm CAL) as Group 3.

Exclusion criteria

- Female patients were excluded
- Patients with uncontrolled systemic conditions
- Smokers
- History of periodontal treatment or use of vitamins, antibiotics, or iron supplements within the previous 6 months
- Individuals who suffer from any acute or chronic medical conditions including diabetes or viral, fungal, bacterial infections
- Individuals who suffered from malaria or jaundice in the past 1 year
- Patients who underwent antibiotic therapy, anti-inflammatory steroids or non-steroids, anticoagulants, immunosuppressants, and cholesterol regulators.

Method of data collection

Healthy controls, chronic generalized gingivitis patients, and chronic generalized periodontitis patients were initially screened for inclusion in the study. The periodontal status of the patients included in the study was recorded using the gingival index (Loe and Silness 1963), plaque index (Silness and Loe 1964), probing pocket depth, and CAL. Under aseptic conditions about 2 mL of venous blood was drawn from the antecubital fossa using a disposable syringe. The collected blood samples were estimated by an automated analyzer for a number of RBC, Hb% concentration, white blood corpuscles, mean corpuscular volume (MCV), mean corpuscular Hb (MCH), MCHC, ESR, and packed cell volume.

RESULTS

The distribution of participants across different age groups and oral health conditions (gingivitis and periodontitis) is presented in Table 1.

MCV

In the Healthy group, 12 subjects (24%) have MCV values below the reference range. In the Gingivitis group, 24 subjects

Table 1: Distribution of participants by age groups and oral health conditions

Age group	Healthy (%)	Gingivitis (%)	Periodontitis (%)	Total (%)
0–10	0 (0)	0 (0)	0 (0)	0 (0)
10–20	0 (0)	0 (0)	0 (0)	0 (0)
21–30	50 (100)	41 (82)	0 (0)	91 (60.6)
31–40	0 (0)	9 (18)	0 (0)	9 (6)
41–50	0 (0)	0 (0)	26 (42)	26 (17.3)
51–60	0 (0)	0 (0)	24 (26)	24 (16)
61–70	0 (0)	0 (0)	0 (0)	0 (0)
71–80	0 (0)	0 (0)	0 (0)	0 (0)
Total	50 (100)	50 (100)	50 (100)	150 (100)

Table 2: Comparison of three groups (healthy, gingivitis, and periodontitis) with respect to hemoglobin values

Group	Mean	SD
Healthy	13.22	2.61
Gingivitis	12.17	2.98
Periodontitis	11.77	1.75
F	4.422	
P	0.014 (significant)	

Table 3: Comparison of three groups (healthy, gingivitis, and periodontitis) with respect to mean corpuscular volume

Group	Mean	SD
Healthy	80.46	3.19
Gingivitis	84.22	4.98
Periodontitis	46.08	6.76
F	15.204	
P	0.000 (highly significant)	

Table 4: Comparison of three groups (healthy, gingivitis, and periodontitis) with respect to mean corpuscular hemoglobin values

Group	Mean	SD
Healthy	27.30	1.61
Gingivitis	27.20	2.11
Periodontitis	28.52	3.24
F	4.622	
P	0.011 (significant)	

Table 5: Comparison of three groups (healthy, gingivitis, and periodontitis) with respect to mean corpuscular hemoglobin concentration values

Group	Mean	SD
Healthy	33.52	1.76
Gingivitis	33.16	2.54
Periodontitis	33.44	2.65
F	0.322	
P	0.718 (Not significant)	

Table 6: Number and percentage of subjects with parameters below the reference range

Parameter	Healthy	Gingivitis	Periodontitis	Reference Range
MCV	12 (24)	24 (68)	37 (74)	83–101
MCH	33 (66)	34 (68)	39 (78)	27–32
MCHC	46 (92)	38 (76)	34 (68)	31.5–34.5
HB	22 (44)	26 (52)	12 (24)	13–17

(68%) have MCV values below the reference range. In the Periodontitis group, 37 subjects (74%) have MCV values below the reference range. Overall, there is a high prevalence of MCV

(Tables 1-3) values below the reference range in all groups, possibly indicating a trend of microcytic anemia.

MCH

In the Healthy group, 33 subjects (66%) have MCH values below the reference range. In the Gingivitis group, 34 subjects (68%) have MCH values below the reference range. In the Periodontitis group, 39 subjects (78%) have MCH values below the reference range. Similar to MCV (Table 4), a significant proportion of subjects in all groups exhibit MCH values below the reference range, which could further suggest anemia.

MCHC

In the Healthy group, 46 subjects (92%) have MCHC values below the reference range. In the Gingivitis group, 38 subjects (76%) have MCHC values below the reference range. In the Periodontitis group, 34 subjects (68%) have MCHC values below the reference range. The majority of subjects in all groups show MCHC (Tables 5 and 6) values below the reference range, potentially indicating hypochromic anemia.

HB

In the Healthy group, 22 subjects (44%) have Hb values below the reference range. In the Gingivitis group, 26 subjects (52%) have Hb values below the reference range. In the Periodontitis group, 12 subjects (24%) have Hb values below the reference range. There is a substantial number of subjects in all groups with Hb values below the reference range, suggesting a potential presence of anemia. The observed high percentages of subjects with parameter values below the reference ranges for MCV, MCH, MCHC, and Hb in all three groups indicate a prevalence of anemia-related conditions.

DISCUSSION

Localized infections within the periodontal tissues that lead to periodontitis can exert a notable impact on an individual's overall systemic health. When these periodontal tissues encounter bacterial agents and their byproducts, the immune system responds with inflammation, setting off a significant vascular reaction. Challenges posed by such agents at the systemic level also trigger a robust immune response. Not only infections, but also factors such as malignancies and autoimmune dysregulation activate the immune system, resulting in the release of inflammatory cytokines such as TNF- α , IL-1, and IL-6. These cytokines can negatively influence the production of Epo, ultimately contributing to the development of anemia.^[6]

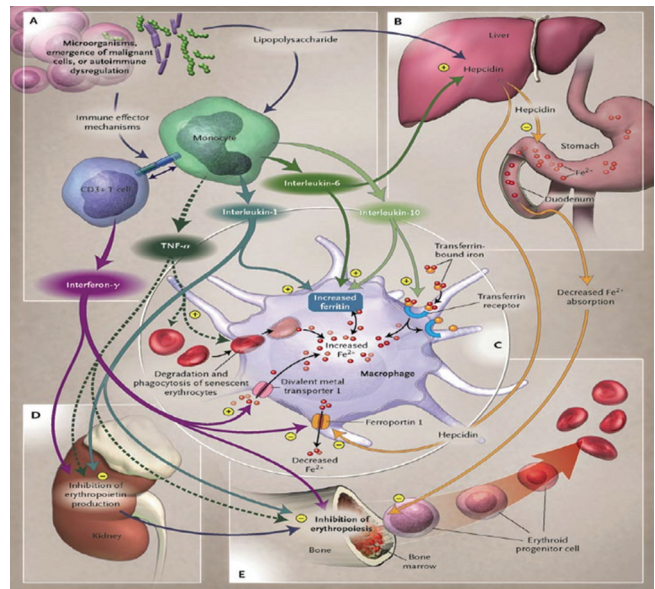
The current research aimed to evaluate the impact of periodontal inflammation on the peripheral blood of individuals with chronic generalized periodontitis. The connection between anemia and periodontitis has been subject to investigation in the latter part of the 20th century. Some studies have delved into both the ideas of anemia as a potential cause of periodontitis and periodontitis as a possible contributor to anemia. There was a prevailing belief that anemia might play a role in triggering

periodontitis, rather than being a result of it.^[7] Lainson *et al.* proposed that anemia serves as a systemic factor contributing to the development of periodontitis.^[8] Wu *et al.* conducted a similar study in which they found that periodontitis leads to a reduction in Hb concentration and disrupts the equilibrium of iron metabolism. This strengthens the link between periodontitis and the inclination for the development of AI, particularly in cases of severe periodontitis.^[9]

In this study, we focused on a male population, drawing parallels with a previous investigation by Patel *et al.* Our findings reinforce the notion that chronic periodontitis holds the potential to contribute to the onset of anemia. This alignment with previous research highlights the significance of our results and underscores the broader implications of periodontal health on systemic well-being. The observed association between chronic periodontitis and anemia underscores the need for a comprehensive understanding of the intricate interplay between oral health and overall systemic health.^[10]

In comparison with our study, the findings unveiled intriguing trends concerning the distribution of oral health conditions across different age groups. The prevalence of gingivitis predominantly manifested in the late adolescent age group (21–40 years), encompassing 42% of the cases. This observation aligns with the notion that young adults are often more susceptible to gingival inflammation due to various factors such as hormonal changes and oral hygiene practices. On the other hand, chronic periodontitis displayed a distinct pattern, with the majority of cases occurring among individuals in the early elderly age group (41–80 years), constituting 33.34% of the total cases. This outcome underscores the potential impact of aging on the progression of periodontal conditions. These results were similar to the study conducted by Tadjoeidin *et al.*^[11]

In the context of our study, a notable positive association has emerged between the presence of periodontitis and the occurrence of anemia, attributed to decreased Hb levels. This finding corresponds to the results of a study conducted by Wu *et al.*, reinforcing the credibility of our observations where we found a statistically significant association between decreased Hb concentration in patients with periodontitis. The correlation observed between periodontitis and anemia highlights a potential link between oral health and systemic well-being. A diminished Hb level can indicate reduced oxygen-carrying capacity in the blood, which is not only a hallmark of anemia but also holds broader implications for overall health. The study conducted by them concluded that periodontitis decreases Hb concentration and disturbs the balance of iron metabolism which confirms a strong association between periodontitis and the development of AI.^[12] Another study conducted by Ranjit *et al.* also found similar findings such as our study concluding that chronic periodontitis patients had lower Hb levels which suggests that chronic periodontitis may be associated with increased risk for anemia.^[13-16]



CONCLUSION

Our study has revealed a highly significant positive association between periodontitis and the occurrence of anemia, particularly due to the decreased mean corpuscular volume (MCV) and MCH values observed. This finding is consistent with a study conducted by Botelho *et al.*, providing additional weight to our results and reinforcing the credibility of the observed association. The study conducted by them on the analysis found reduced levels of mean corpuscular value along with other blood parameters concluding that the size of the RBCs was smaller than usual in periodontitis patients which is likely to be indicative for the occurrence of anemia in periodontitis patients.^[14] Our study did not find any statistical significance in MCH concentration similar to a study conducted by Anumolu *et al.*^[15]

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