European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 07, Issue 01, 2020

ASSOCIATION BETWEEN HAEMOGLOBIN LEVEL AND SEVERITY OF PERIODONTITIS - AN INSTITUTION BASED STUDY

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ABSTRACT

The aim of the study was to investigate the association between haemoglobin level & severity of chronic periodontitis. This retrospective study was carried out by analysing the patient records from June 2019 to March 2020 at Saveetha Institute of Medical & Technical sciences (SIMATS).Two forty four patients were included in the study. Parameters assessed were a)Demographic details – Patient name, Patient identity number, Age & Sex; b)Periodontal parameters – Probing pocket depth (PDD), Loss of attachment (LOA), Bleeding on probing (BOP), Severity of Periodontitis (mild, moderate & severe);c) Blood parameters - Haemoglobin levels (g/dl). Data was analysed using SPSS version 23.0. Bivariate Pearson correlation of Haemoglobin with mean PPD, mean LOA & mean BOP score were calculated. Mean Hb was compared with severity of periodontitis using ANOVA. A total of 244 patients were included in the study. The mean age of the study sample was 40.42 (±11.38). Females constituted about 58.06%, whereas males constituted 41.4% of the study sample. Majority of the population had severe periodontitis (64.76%), followed by mild periodontitis (18.03%) & moderate periodontitis (17.21%). The mean haemoglobin level in severe periodontitis (13.35g/dl) is higher when compared to moderate and mild periodontitis (13.30g/dl & 13.18g/dl respectively). Mean PPD was 5.24 mm, mean LOA was 4.6 mm & mean BOP score was 0.98. Association between mean CAL and mean haemoglobin levels was positive and statistically significant with a p value of 0.012. Mean Hb level was not significantly different with varying severity of periodontitis
(p = 0.86). Thus, from this retrospective study, there was no significant association between haemoglobin levels and severity of periodontitis.

Keywords : Anemia; Chronic periodontitis; Haemoglobin; Periodontal disease; Periodontitis.

INTRODUCTION

Periodontitis is a chronic inflammatory condition, characterised by destruction of the supporting structures of the teeth. Causes of periodontitis are multifactorial and it is affected by several risk factors. Gram-negative anaerobic bacteria are considered to be the primary pathogen that are involved in periodontal destruction. In recent days, viruses like cytomegalovirus (CMV) and Epstein–Barr virus (EBV) are found to be part of the etiopathogenesis of chronic periodontitis (Priyanka*et al.*, 2017). Chronic periodontitis is a host mediated inflammatory disease where there are elevated levels of cytokines and other inflammatory mediators. Tumor necrosis factor (TNF) is one of the major proinflammatory cytokines that is involved in the destruction of periodontium(Varghese *et al.*, 2015). The role of IL-1,6,8, & 12 has been periodontal

destruction is well established. Recently, interleukin-21 has (IL-21) obtained importance in causing excessive tissue inflammation and injury (Moothaet *al.*, 2016). A vasoconstrictor, Endothelin - 1 (ET-1) has been found to be associated with increased expression of pro-inflammatory cytokines. It is expressed in gingival tissues of patients with periodontitis (Khalid *et al.*, 2016, 2017). The diagnosis of periodontal disease is done by assessing the clinical parameters such as probing depth, attachment level, bleeding on probing (BOP) and radiographic loss of alveolar bone. Advanced radiographic diagnosis using Cone beam computed tomography can aid (Kavarthapu and Thamaraiselvan, 2018). Untreated periodontitis might lead to loss of teeth, function and aesthetics (Ramesh *et al.*, 2019,Thamaraiselvan *et al.*, 2015). The lost dentition can be replaced by dental implants, which have become a crucial part of prosthetic rehabilitation in periodontitis over the last few years (Ramesh, Ravi and Kaarthikeyan, 2017).

Initial phase of periodontal therapy includes scaling, root planing, systemic antimicrobials, and plaque control methods.Commonly, mouth washes like chlorhexidine, triclosan, cetylpyridinium chloride, have been used in the oral hygiene maintenance. Chlorhexidine mouthwash is considered as the gold standard due to its substantivity. But it has adverse effects like unpleasant and altered taste sensation. Hence, herbal remedies have been used to achieve antimicrobial, antioxidant, and anti-inflammatory effects (Ramesh, SheejaSaji Varghese, *et al.*, 2016). Herbal substances like triphala extract mouthwash, Hioramouthwash,etc can be used as an alternative (Ramamurthy and Mg, 2018). Intra bony or angular defects can be managed by periodontal regenerative procedures. Along with bone graft materials, growth factors like platelet-derived growth factor, transforming growth factor, epidermal growth factor, vascular endothelial growth factor and insulin-like growth factor, epidermal growth factor can be used as an adjunct (Panda *et al.*, 2014; Ravi *et al.*, 2017). Recently, stem cells from PDL, dental pulp and tooth follicle have also been used for regenerative therapy (Avinash, Malaippan and Dooraiswamy, 2017).

The microbial challenge in chronic periodontitis affects the integrity of the sulcular epithelium, which is the protective barrier for the periodontal structures (Newman *et al.*, 2018). This discontinuity in the sulcular epithelium acts as an access to the bacterial toxins to enter the connective tissue and hence into the systemic circulation (Lindhe, Lang and Karring, 2008). In response to the released bacterial products, the host stimulates the production of c reactive proteins, interleukin – 6 and tumor necrosis factor-α (TNF-α). This leads to depression in erythropoietin production, causing the development of anemia.

Evidence from several epidemiological studies proposed that periodontal destruction can act as a risk factor for systemic conditions like cardiovascular diseases (Mustapha *et al.*, 2007), diabetes mellitus (Mealey and Rose, 2008), atherosclerosis (Simet *al.*, 2008) and chronic obstructive respiratory diseases (Ramesh, Sheeja S. Varghese, *et al.*, 2016).Ebersole JL et al, from his study, found that periodontal infections can produce changes in the blood chemistry (Ebersole and Cappelli, 2000). For many decades, blood has been considered as the most vital body fluid that reveals disease processes. In the past few years, there is an increased interest to investigate the association of periodontitis and changes in the peripheral blood.

Anemia is defined as a decrease in the human haemoglobin concentrations below the normally acceptable levels. It is one of the most commonly encountered health issues in the developing countries.Anemia of chronic disease (ACD) is considered as one of the most common forms of anemia seen in clinical medicine (Lee, 1983; Beutler, 1988, Means, Dessypris and Krantz, 1992). It is defined as the anemia occurring in chronic infections, inflammatory conditions or neoplastic disorders that is not due to marrow deficiencies or other diseases, and occurring despite the presence of adequate iron stores and vitamins (Lee, 1983; Beutler, 1988, Means, Dessypris and Krantz, 1992). It is multifactorial anemia, common along with iron deficiency. It is the second most prevalent form of anemia after iron deficiency anemia. This form of anemia is associated with chronic infections, non infectious inflammatory diseases, and malignancies (Venkata Naga Sri, Srikanth and Paidi, 2016). It develops after a period of around 2 months of active disease. An unique finding of the disorders that are associated with ACD was elevated levels of inflammatory mediators like tumor necrosis factor, interleukin - 1, and interferon. These cytokines bring

about processes like reduced red cell life span, impaired response of erythropoietin to anemia, aberrant mobilization of reticulo endothelial iron stores (Means, 2019). There are only a few studies that determined the haemoglobin level in relation to periodontitis. The aim of the present study is to examine the association between haemoglobin level and severity of chronic periodontitis.

MATERIALS & METHOD

Study design

This is a retrospective study, carried out by analysis of the patient records from from June 2019 to March 2020 were assessed. The study design was reviewed and approved by the Ethical Committee of Saveetha Institute of Medical and Technical Sciences (SIMATS).

Study population

Data from two hundred and forty four patients who were diagnosed with chronic periodontitis and referred to the department of Periodontics, Saveetha Institute of Medical and Technical Sciences (SIMATS) were included in the study. Patients with aggressive periodontitis or any systemic diseases that may influence the periodontium like diabetes, pregnancy, immunological disorders & smokers were excluded from the study. Case sheets with incomplete data were excluded from the study.

Parameters assessed

a) Demographic details – Patient name, Patient identity number, Age & Sex.
b) Periodontal parameters – Probing pocket depth (PDD), Loss of attachment (LOA), Bleeding on probing (BOP).
c) Severity of Periodontitis -(Aljohani, 2010)
   i) Mild periodontitis - LOA = < 3 mm;
   ii) Moderate periodontitis - LOA = 3-4 mm at ≥ 30% sites;
   iii) Severe periodontitis - LOA ≥ 5 mm at ≥ 30% of sites
d) Blood parameters - Haemoglobin level (g/dl), obtained from Clinical lab records.

Statistical analysis

All descriptive data were analysed using frequency distributions; Bivariate Pearson correlation of Haemoglobin level with mean PPD, LOA was calculated. Mean Haemoglobin was compared among patients with mild, moderate & severe periodontitis using one way Analysis of Variance (ANOVA). Statistical significance was set at $p < 0.05$. Analyses were conducted with a statistical software SPSS version 23.0 (Statistical Package For The Social Sciences).

RESULTS & DISCUSSION

A total of two hundred and forty four patients were included in the study.The mean age of the study sample was 40.82 (± 11.38). Females constituted about 58.06%, whereas males constituted 41.4% of the study sample (Figure 1). About 64.76% of the study population had severe periodontitis, 17.21% had moderate periodontitis and 18.03% had mild periodontitis (Figure 2).
Mean haemoglobin level was compared with varying severity of periodontitis in the total study sample using ANOVA. The mean haemoglobin level of severe periodontitis patients (13.35 g/dl) was higher when compared to moderate (13.30 g/dl) and mild periodontitis patients (13.18 g/dl) However, there was no statistically significant difference in haemoglobin levels with severity of periodontitis ($p = 0.86$) (Figure 3).Bivariate Pearson correlation of Haemoglobin level with mean PPD, LOA and mean BOP score was calculated. The CAL is positively and significantly associated with Haemoglobin levels with Pearson

correlation coefficient of 0.211, and p value of 0.012 (Figure 5). The PPD did not show significant correlation with Haemoglobin levels (p = 0.074) (Figure 4).

In the current study, the CAL is positively and significantly associated with Haemoglobin levels. There was no statistically significant difference in haemoglobin levels with severity of periodontitis. This findings is in accordance with the studies done by Aljohani et al, Wakai et al &Havemose-Poulsen et al (Aljohani, 2010,Wakai *et al.*, 1999; Havemose-Poulsen*et al.*, 2006). This may be attributed to the smaller sample size in the present study. Also, this can be overcomed in further research by minimizing the difference in the sample size between different groups. Another possible hypothesis is that " as long as the patient is having periodontitis, the haemoglobin level will not differ among different severity". The addition of a control group without periodontitis will help to investigate the validity of this hypothesis. A few previous studies in the literature have assessed the bidirectional relationship between anemia and periodontitis. Goldstein,Siegel, Lainson et al., and Chawala et al. were the first to examine anemic status in patients diagnosed with periodontitis (Goldstein, 1938; Seigel, 1945; Lainson, Brady and Fraleigh, 1968; Chawla*et al.*, 1971). Most of these authors thought anemia to be one of the causative factors of periodontal disease, rather than anemia developing as a consequence of periodontitis (Goldstein, 1938; Seigel, 1945; Lainson, Brady and Fraleigh, 1968; Chawla*et al.*, 1971). Literature review shows that microbes and their products stimulate cells like fibroblasts, keratinocytes and macrophages that are present in the periodontium, causing release of cytokines and inflammatory mediators such as prostaglandin E2, tumor necrosis factor - alpha (TNF- α), Interleukins (IL -1β, IL-6 & IL-12) (Kabashima*et al.*, 2002; Sugiyama *et al.*, 2002; Fokkema, Loos and Van DER VELDEN, 2003; Garlet*et al.*, 2005; Taba*et al.*, 2005; O'Connell *et al.*, 2008). This increase in the levels of cytokines in the gingival connective tissue in periodontitis, may lead to elevated mediators in blood circulation, which can induce systemic effects (Graves *et al.*, 2006).

Several studies have been conducted to evaluate the relationship between Haemoglobin levels and periodontitis. Patients diagnosed with periodontitis have lower hematocrit, lower erythrocyte counts, lower haemoglobin levels and elevated red blood cell sedimentation rate, when compared to healthy controls (Rao, Ramesh and Thomas, 2013). Haemoglobin levels and erythrocyte count increased in patients with severe periodontitis after non surgical periodontal therapy. Whereas, following surgical management of periodontitis, there was a significant improvement in haemoglobin level and erythrocyte count in patients who were diagnosed with anemia (Agarwal, Kumar and Gujjari, 2009).

Limitations & Future scope

Our study did not compare the haemoglobin levels between healthy controls & periodontitis patients There is a sampling bias since only the patients who were referred to the department of periodontics were included in the study.Further longitudinal studies with larger sample size are needed to assess the association between haemoglobin levels and various types of periodontitis, and the effect of periodontal treatment on haemoglobin level.

CONCLUSION

From this retrospective study, there was no significant association between haemoglobin levels and severity of periodontitis. However, the relation between anaemia of chronic disease and chronic periodontitis is bitemporal and could be a cause & effect relation. To prove the cause and effect relationship between haemoglobin levels & periodontitis, further longitudinal study have to be done with larger sample size.

AUTHOR CONTRIBUTIONS

1. SubasreeSoundarajan : Conception and design of study, Acquisition of data, analysis and interpretation of the data, drafting of the manuscript, & revising the manuscript critically for intellectual content.
2. SankariMalaiappan - Conception and design of study, analysis and interpretation of the data, revising the manuscript critically for intellectual content & approval of the version of the manuscript to be published.
3. PriyalochanaGajendran - Revising the manuscript critically for intellectual content & approval of the version of the manuscript to be published.

CONFLICT OF INTEREST

Nil

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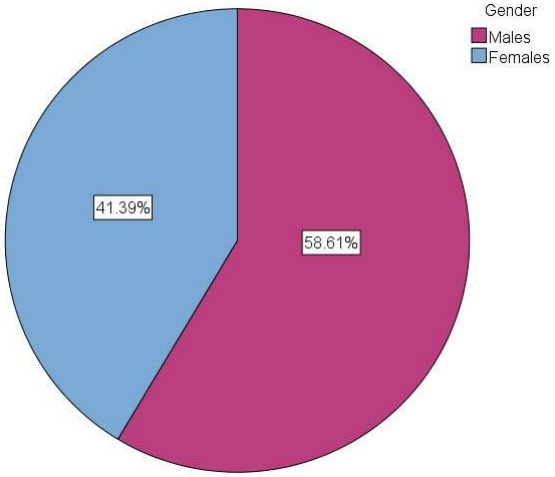

Figure 1 : Pie chart representing gender distribution of the study population. Purple denotes males and blue denotes females. The distribution of study population showed more males (58.6%) than females (41.39%).

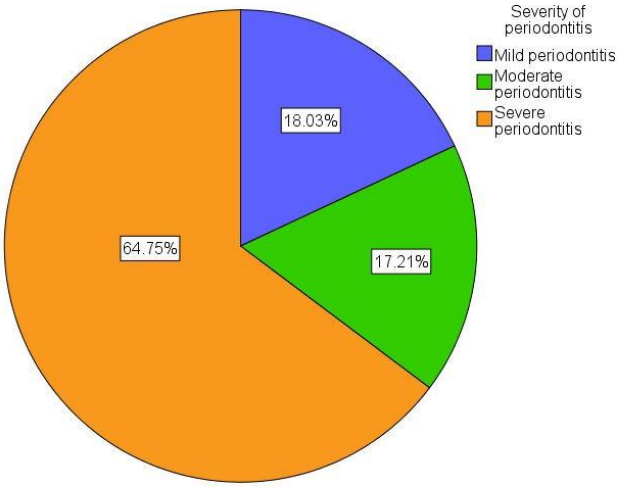

Figure 2: Pie chart representing Severity of periodontitis in the study population. Blue denotes Mild periodontitis (LOA = < 3 mm), green denotes Moderate periodontitis (LOA = 3-4 mm at ≥ 30% sites), orange denotes Severe periodontitis (LOA ≥ 5 mm at ≥ 30% of sites). From the above values, we can infer that the majority of the population had severe periodontitis (64.76%), followed by mild periodontitis (18.03%) & moderate periodontitis (17.21%).

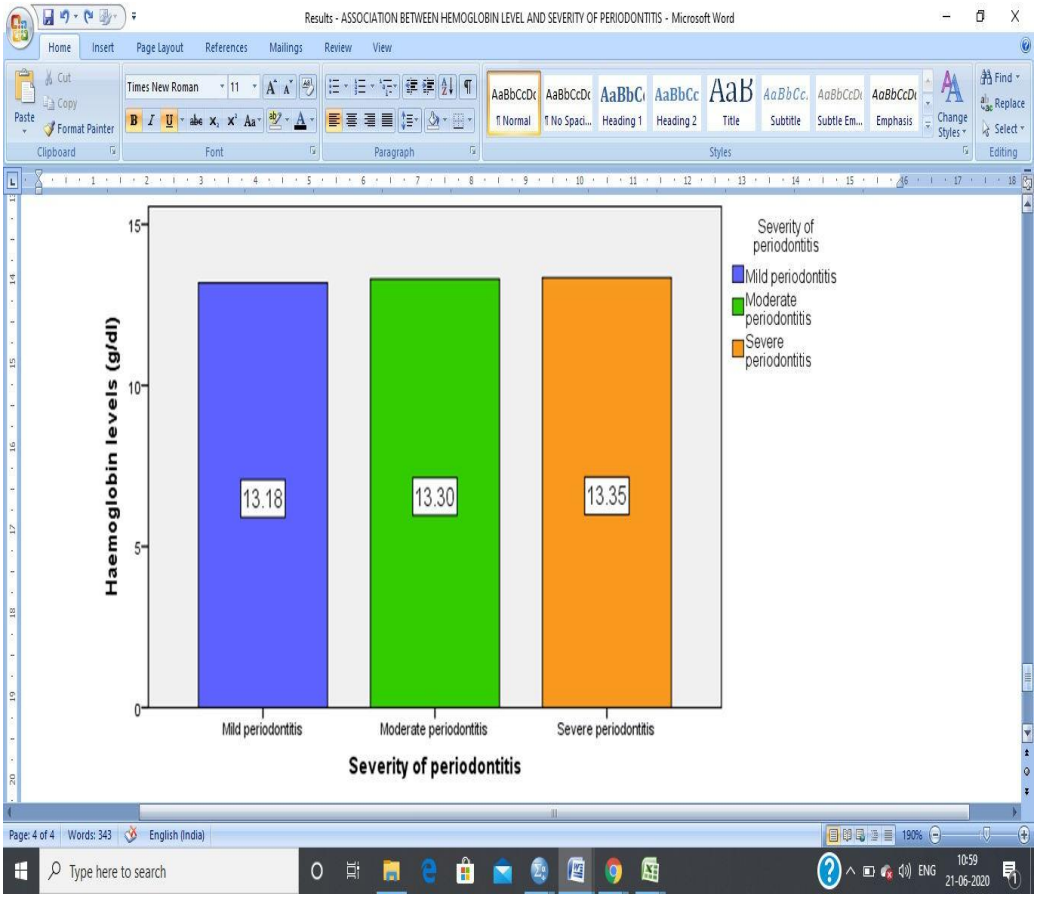

Figure 3 : Bar graph depicting the mean haemoglobin levels of the patients with different severity of periodontitis. X axis represents severity of periodontitis & Y axis represent the mean haemoglobin levels (g/dl).Blue denotes Mild periodontitis (LOA = < 3 mm), green denotes Moderate periodontitis (LOA = 3-4 mm at ≥ 30% sites), orange denotes Severe periodontitis (LOA ≥ 5 mm at ≥ 30% of sites).Relationship between mean haemoglobin levels and severity of periodontitis was not statistically significant. (ANOVA; df - 2; p value - 0.860, >0.05, hence statistically insignificant). From this figure 3, we can infer that the haemoglobin level in severe periodontitis is higher when compared to moderate and mild periodontitis.

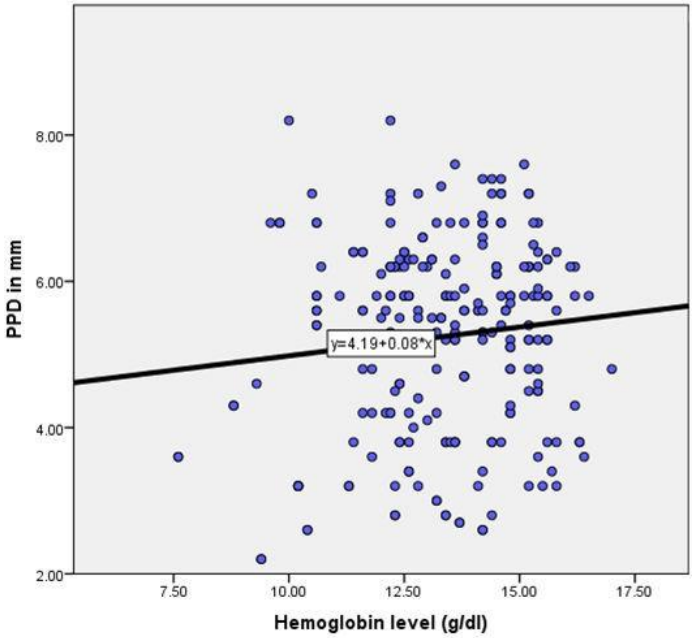

Figure 4 : Scatter plot depicting the correlation between Haemoglobin levels & Mean Probing pocket depth (PPD). X axis represents mean PPD and Y axis represents haemoglobin levels. Mean PPD did not show statistically significant correlation with haemoglobin levels (Pearson correlation coefficient : 0.107, p value : 0.074 > 0.05 - statistically insignificant).From the figure 4, we can infer that mean PPD increases with increase in haemoglobin levels of the periodontitis patients, however,the correlation is not statistically significant.

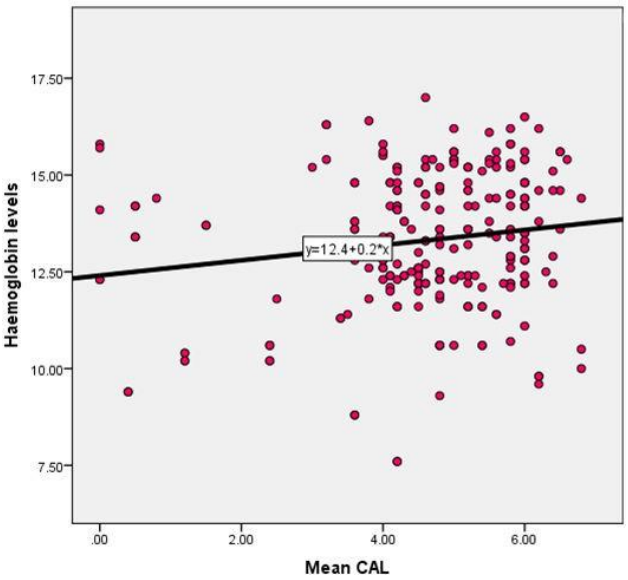

Figure 5 : Scatter plot depicting the correlation between Haemoglobin levels & Mean clinical attachment loss (CAL). X axis represents mean CAL and Y axis represents haemoglobin levels. Mean CAL showed statistically significant correlation with haemoglobin levels (Pearson correlation coefficient : 0.211, p value : 0.012 < 0.05 - statistically significant). From the figure 5, we can infer that mean CAL increases significantly with increase in haemoglobin levels of the periodontitis patients.