The correlation between hemoglobin level and generalized moderate chronic periodontitis

Suzan Ali B.D.S, M.Sc. (1)

ABSTRACT

Background: As the periodontal tissues mount an immune inflammatory response to bacteria and their products, systemic challenge with these agents also induces a major vascular response. Certain inflammatory cytokines produced during periodontal inflammation, can depress erythropoietin production leading to the development of anemia. (1) This study aimed to investigate the association between hemoglobin level and generalized moderate chronic periodontitis.

Materials and Methods: Data were collected from 60 systemically healthy male of an age ranged (30-60 years old) 30 of them with generalized moderate chronic periodontitis (CAL ≥ 3-4 mm at ≥ 30% of sites) and 30 of them with healthy periodontium as control group. Full mouth examinations (excluding third molars) were conducted for all patients. Four sites were examined for each tooth (buccal, lingual, mesial and distal). Plaque index (PI) (2), bleeding on probing index (BOP) (3), Probing Pocket depths (PPD), and Clinical attachment level (CAL) were recorded using a marked periodontal probe (Williams probe) and measurement of hemoglobin (Hb) concentration in the blood by colorimetric cyanometemoglobin method (4).

Results: Mean of hemoglobin level was (12.527) for the study group whiles its (14.72) for the control group, highly significant differences were apparent between the two groups regarding the hemoglobin level (P-value 0.01). About the Correlation between the hemoglobin level and the periodontal parameters, the PLI, CAL scores were positively but non-significantly associated with the hemoglobin level. (P>0.05). Correlation coefficient (r) between PLI and hemoglobin level was (0.30). For the CAL The correlation coefficient (r) was (0.159). Strong and significant correlation were found between BOP and the hemoglobin level (r = 0.343, P value = 0.049).

Conclusion: There is an association between hemoglobin levels and periodontal status.

Key words: hemoglobin level, chronic periodontitis, anemia. (J Bagh Coll Dentistry 2012; 24(sp. Issue 1):85-88).

INTRODUCTION

Extraordinary progress is being made in understanding the relationship between periodontal disease and systemic health. Periodontitis, one of the oldest and most common diseases of humans, was once generally believed to be an inevitable consequence of aging, and it is a chronic infection that produces a local and systemic host response, as well as a source of bacteremia. (5) It is caused by a complex mix of anaerobic, Gram-negative bacteria. The clinical symptoms of this infection include swollen red gingiva, gingival bleeding and suppuration; formation of periodontal pocket; gingival recession, and loss of alveolar bone. Prevalence of periodontal diseases varies among different countries. In the US and Europe, moderate or severe forms of periodontal diseases affect 40% or 15%, respectively, of the adult population (6, 7), whereas in Japan a prevalence of 23.4% was reported (8). Epidemiologic studies suggested that periodontal deterioration increases the risk of systemic problems such as cardiovascular diseases (9), atherosclerosis (10), diabetes mellitus (11), and preterm low birth weight of infants (12). These associations suggest that periodontal diseases have systemic effects. In addition, some studies had found that periodontal infection elicits systemic blood chemistry changes (13).

For thousands of years, blood has been regarded as the ultimate body fluid that could indicate disease process. In the past decade, there has been a renewed interest to study the association of periodontitis and changes in the cellular and molecular components of peripheral blood. For example the relationship of periodontitis with leukocytes (14, 15), thrombocytes (16), and red blood cells has been investigated (17).

Anemia of chronic disease (ACD) has been described in the literature, and seems to be one of the most common forms of anemia observed in clinical medicine (18,19). ACD is defined as the anemia occurring in chronic infections, chronic inflammatory processes or tumor formation that is not due to dysfunction of bone marrow cells or other diseases, and occurring despite the presence of adequate iron stores and vitamins (19). A characteristic finding of the disorders associated with ACD was the increased production of the cytokines that mediate the immune or inflammatory response; such as tumor necrosis factor, interleukin-1, and the interferon. All the processes involved in the development of ACD can be attributed to these cytokines, including shortened red cell survival, blunted erythropoietin response to anemia, impaired erythroid colony formation in response to erythropoietin, and abnormal mobilization of reticuloendothelial iron stores (20). These cytokines are also released by periodontal tissues in response to bacterial...
infection, which suggests that periodontitis like other chronic disease may cause ACD.

There are only a few studies that investigated the red blood cell parameters, especially hemoglobin level, in relation to periodontitis so the aim of the present study is to investigate the association between hemoglobin level and generalized moderate chronic periodontitis.

MATERIALS AND METHODS

Study Design

A cross-sectional double-blind study. The examiners were not aware of the hemoglobin level of the patients and the laboratory technicians were not aware of the periodontal status of the patients. Data were collected from 60 systemically healthy male of an age ranged (30-60 years old) 30 of them with generalized moderate chronic periodontitis (CAL ≥ 3.4 mm at ≥ 30% of sites) (21) and 30 of them with healthy periodontium as control group. Patients were advised of their role in this study and asked to provide informed consent. Extensive medical and dental histories were recorded for each patient. Patients with aggressive periodontitis or any systemic disorder that may affect the periodontal tissue (such as diabetes, pregnancy and immunological disorders), anemic patient, and smokers were excluded from the study. Periodontal Examination: Full mouth examinations (excluding third molars) were conducted for all patients. Four sites were examined for each tooth (buccal, lingual, mesial and distal). Plaque index (PI) (2), Gingival Index (GI) (3) and probing on probing index (BOP) (21). The percentage of sites that bleed was recorded for each patient (%BOP). If bleeding occurs with in 30 seconds after probing, the site was given score (1) where as (0) score for non-bleeding site. (4). Probing Pocket depths (PPD) was measured from the free gingival margin (GM) to the base of the pocket. , and Clinical attachment level (CAL) was determined at all sites by measuring the distance from the cemento-enamel junction (CEJ) to the GM, adding the PD at the same site: CAL = PPD + (CEJ to GM). Data were collected and recorded using a Williams's periodontal probe. Under aseptic conditions, venous blood was drawn from ante-cubital fossa (1.5ml). The blood was collected in heparinized test tube and transported to a laboratory for processing within 2 hours after venepuncture. Erythrocytes and plasma were separated by centrifugation and hemoglobin (Hb) concentration was measured by colorimetric cyanmethoglobin method using a commercial kit (Hemoglobin test-Wako,WakoPure Chemical Industries, Japan) based on the method of Van Kampen and Zijlstra (22).

Statistical Analysis

Data were analyzed using statistical package for social sciences (SPSS, version 15). Means and standard deviations of the variables were calculated. And Correlation of Hb with PLI, GI, CAL, PD, and BOP were calculated.

RESULTS

Sixty subjects have been involved in these study 30 males with moderate generalized chronic periodontitis represent the study group and 30 males with healthy periodontium as control group. Mean and standard deviation of the periodontal parameters (PLI, GI, BOP, PD, CAL) of the study and control groups were shown in table (1). Mean of hemoglobin level was (12.52) for the study group whiles its (14.72) for the control group, highly significant differences were appeared between the two groups regarding the hemoglobin level (P-value P<0.01) as shown in table (2).

Correlation between the hemoglobin level and the periodontal parameters were shown in table (3). For the chronic periodontitis group, the PLI, CAL scores were positively but none significantly associated with the hemoglobin level. \( P > 0.05 \).Correlation coefficient \((r)\) between PLI and hemoglobin level was \((0.30)\). For the CAL The correlation coefficient \((r)\) was \((0.159)\). Strong and significant correlation were found between BOP and the hemoglobin level \((r = 0.343, P value = 0.049)\), while weak and non significant correlation were found between GI, PPD with the hemoglobin level. For the GI \((r=0.09, P value =0.62)\) and for PPD \((r= 0.075, P value =0.688)\).

DISCUSSION

Anemia of chronic disease is the second most prevalent form of anemia after nutritional, iron-deficiency anemia, and can coexist together, causing additional anemic burden. ACD is a cytokine-mediated anemia characterized by hypoferremia, with adequate reticuloendotelial iron stores and normal-to-elevated ferritin concentrations. The current study investigates the correlation between hemoglobin level and the generalized moderate chronic periodontitis in systemically healthy patients. This study support the hypothesis there is an association between hemoglobin levels and periodontal status. A few early reports in the literature have investigated the bidirectional relationship between anemia and periodontitis. Siegel (21), Lainson et al. (24) were observe anemia in periodontitis. In this study the mean of hemoglobin level was lower in patients.
with chronic periodontitis than their level in the control group. This result are in agreement with Waki et al (8), Agarwal et al (25) Sukru Enhos et al (26) Havemose-Poulsen et al (27), Gokhale SR, et al (28), Pradeep AR. et al (29) and Balwant Rai1 (30) its due to .1. Strong evidence indicates that pathogenic bacteria or their products of the periodontal disease can stimulate cells such as fibroblasts, keratinocytes, and macrophages, which are present in periodontal tissue, to release a number of inflammatory cytokines, such as tumor necrosis factor-alpha (TNF-α); prostaglandin E2; interleukins (IL-1β, IL-6, and IL-12); 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 protein (MIP)-1α, that are relevant to inflammatory process in periodontal diseases. The elevation in cytokine and chemokine by cells within the gingival connective tissue in chronic periodontitis lesion associated with elevated levels of systematically-circulating pro-inflammatory cytokines may result in dysregulation of iron homeostasis, depressed erythropoiesis, and a blunted erythropoietin response31(2). Lipopolysaccharides from subgingival periodontopathic microbiota have ready access to the systemic circulation via the ulcerated and discontinuous sulcular epithelium lining the periodontal pocket (32). This subgingival microbiota in patients with periodontitis thus poses a significant, long-standing, Gram-negative, bacterial challenge to the host, resulting in a low-grade systemic inflammation. Elevated levels of various systemic markers of inflammation have been noted in moderate-to-severe periodontal disease. (33) Considering the relatively high prevalence of anemia, as well as periodontal disease. Female patients were excluded from the study population, as the prevalence of anemia is known to be much higher in females of reproductive age. Smokers with periodontitis have been noted as having higher levels of systemic markers related to anemia, (34) thus only non-smokers were included in our study. The present study show strong correlation between CAL, plaque and BOP scores with hemoglobin level in periodontal patients. These results are in agreement with Agarwal et al (25) Sukru Enhos et al (26) Hind A (35) studies. This may be due to elevated Ferritin concentration in gingival crevicular fluid. It is the most sensitive indicator, it is important to note that ferritin is increased by many factors, including infection and inflammation; thus, a high value does not necessarily indicate a good iron status. It serves as a diagnostic indicator for detecting inflammation and other diseases. Further longitudinal studies with larger sample size are needed to investigate the association between hemoglobin levels and different types of periodontitis, and the effect of periodontal treatment on hemoglobin level.

REFERENCES:

Table 1: Means and Standard deviations for the periodontal parameters of the two groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Chronic periodontitis</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>PLI</td>
<td>2.138</td>
<td>0.304</td>
</tr>
<tr>
<td>GI</td>
<td>2.179</td>
<td>0.281</td>
</tr>
<tr>
<td>BOP 0%</td>
<td>44.207</td>
<td>10.388</td>
</tr>
<tr>
<td>BOP 1%</td>
<td>55.95</td>
<td>10.132</td>
</tr>
<tr>
<td>PPD</td>
<td>4.015</td>
<td>0.553</td>
</tr>
<tr>
<td>CAL</td>
<td>2.88</td>
<td>0.546</td>
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</table>

Table 2: Means and Standard deviations for the hemoglobin level of the two groups, t- test were performed to test the differences

<table>
<thead>
<tr>
<th>HB</th>
<th>Chronic Periodontitis group</th>
<th>Control group</th>
<th>t-test</th>
<th>P- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>4.16</td>
</tr>
<tr>
<td>12.52</td>
<td>1.118</td>
<td>14.72</td>
<td>1.22</td>
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Table 3: Correlation coefficient (r) between periodontal Parameters of the two groups and the hemoglobin level

<table>
<thead>
<tr>
<th>Variables</th>
<th>Chronic periodontitis group (HB) 12.52</th>
<th>Control group (HB) 14.72</th>
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<tbody>
<tr>
<td></td>
<td>r</td>
<td>p-value</td>
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<tr>
<td>PLI</td>
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<td>0.087</td>
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<tr>
<td>GI</td>
<td>0.09</td>
<td>0.62</td>
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<tr>
<td>BOP</td>
<td>0.343+</td>
<td>0.049</td>
</tr>
<tr>
<td>PPD</td>
<td>0.075</td>
<td>0.688</td>
</tr>
<tr>
<td>CAL</td>
<td>0.159+</td>
<td>0.401</td>
</tr>
</tbody>
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