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Serum Vitamin D in Patients with Chronic Periodontitis and Healthy Periodontium

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ABSTRACT

Background: Periodontitis is inflammatory disorder resulting in progressive destruction of the periodontal ligament and alveolar bone with pocket formation, recession, or both. Vitamin D has a benefit in bone metabolism and anti-inflammatory activity involving T-cell homeostasis. The objective of this study was to compare the vitamin D level in patient with chronic periodontitis and healthy periodontium and evaluate its correlation.

Methods: A comparative cross-sectional study was done in 80 patients (40 with healthy periodontium and 40 with chronic periodontitis) visiting to Department of Dental Surgery (Periodontology and Oral Implantology Section) of Bir Hospital. Parameters measured were plaque index, gingival index, clinical attachment level and pocket depth for the evaluation of healthy periodontium and chronic periodontitis.

Results: The result showed 16.58±6.65ng/mL and 19.06±11.52ng/mL level of vitamin D in female and male respectively (p-value 0.230) and 16.85±13.30 ng/mL and 19.78±5.87 ng/mL level of vitamin D in healthy and chronic periodontitis groups respectively (p-value 0.209).

Conclusions: There are no differences in the level of serum vitamin D between healthy and chronic periodontitis groups. No association was seen between vitamin D level and chronic periodontitis.

Keywords: Bone metabolism; chronic periodontitis; clinical attachment level; healthy periodontium; vitamin D; periodontal pocket

INTRODUCTION

Periodontitis can be defined as an inflammatory disease of supporting tissues of teeth caused by micro-organisms, resulting in progressive destruction of periodontal ligament and alveolar bone with pocket formation and loss of attachment.[1]

Vitamin D acts as an anti-inflammatory agent by inhibiting expression of inflammatory cytokines and stimulating monocytes/macrophages.[2] Vitamin D directly induces expression of endogenous antimicrobial peptide cathelicidin.[2] It stimulates Receptor activator of nuclear factor kappa-B ligand (RANKL) expression in osteoblasts and bone marrow-derived stromal cells.[3] Grenier et al reported selective inhibition on growth of Porphyromonas gingivalis and a reduction on virulence factor gene expression by 1,25(OH)2D.[3] Dietrich et al[4] had shown association of vitamin D level and chronic periodontitis, but contradictory results had been shown in the study done by Holick et al.[5] The prevalence of periodontitis and vitamin D deficiency in Nepalese populations has been shown higher.[6,7] The aim of this study was to compare level of vitamin D in healthy and chronic periodontitis groups.

METHODS

A comparative cross-sectional study was conducted in patients with healthy periodontium and patients with chronic periodontitis attending Department of Dental Surgery, Bir hospital. Ethical approval was obtained from Institutional Review Board, Ethical Committee of NAMS, Bir Hospital, Kathmandu, Nepal (NAMS-IRB 147/076/077). Informed consent was obtained from patients.

Sample size calculated was 40 for each group (total 80) and was collected on convenience basis of subjects. The study period was for 6 months from February 2019 to

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August 2019. Clinical examination was performed and all parameters were assessed and recorded in proforma. Parameter measured were plaque index, gingival index, clinical attachment level and pocket depth for the evaluation of healthy periodontium and chronic periodontitis. Blood investigation for Vitamin D level was obtained from both the groups.

Inclusion criteria was patients of age 25-54 years with chronic periodontitis based on 1999 classification of periodontal disease[8] and healthy periodontium attending the Department of Dental Surgery, Bir Hospital. Exclusion criteria were patients with systemic diseases that are known to affect the periodontium (diabetes mellitus)[9]; immuno-compromised patients; bone disorders; metabolic disorders; menopausal women; pregnancy and lactating females; uncooperative patient; patients who were not willing to participate and does not give informed consent.

All participants were examined by single examiner AS recording periodontal pocket depth, clinical attachment level in six sites per tooth which was measured using University of North Carolina- 15 periodontal probe. Gingival index and plaque index were examined in four sites per tooth. Blood investigation was done for vitamin D level evaluation for every patient in each group, in Biochemistry laboratory, Bir hospital, National Academy of Medical Sciences. Chemiluminescence Immunoassay (CLIA) machine was used for estimation of vitamin D.

The data were analyzed using IBM SPSS Statistics for Windows, version 16 (IBM Corp., Armonk, N.Y., USA) software and independent t-test was used for comparing the mean of serum vitamin D between patients with healthy periodontium and chronic periodontitis patients and ANOVA was used for analysis of the mean level of serum Vitamin D between different age groups.

RESULTS

Total 80 patients were enrolled in this study, 40 patients had healthy periodontium and 40 were with chronic periodontitis. 24 were female (7 healthy and 17 with chronic periodontitis) and 56 were male (23 healthy and 33 with chronic periodontitis) with mean age of 35.92 years.

Mean Vitamin D level was 16.58±6.65 ng/mL and 19.06±11.52 ng/mL in female and male respectively (p-value 0.230) shown in figure 1.Mean vitamin D level was 16.85±13.30 ng/mL and 19.78±5.87 ng/mL in healthy and chronic periodontitis groups respectively (p-value 0.209) as shown in figure 2.

According to the age group the result showed the mean vitamin D level 16.58±9.23 ng/mL in 24-34 years, 19.13±12.77 ng/mL in 35-44 years, 21.77±4.79 ng/mL in 45-54 years respectively (p-value 0.275) shown in table 1. The result showed mean vitamin D level of 18.31 ng/mL in total sample.

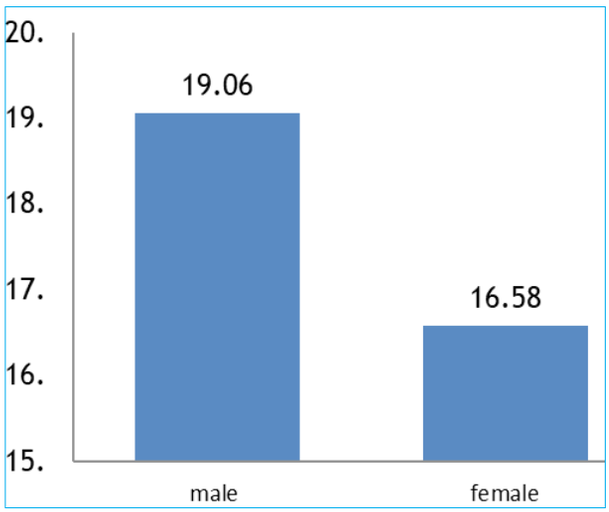

Figure 1. Mean Vitamin D level in male and female.

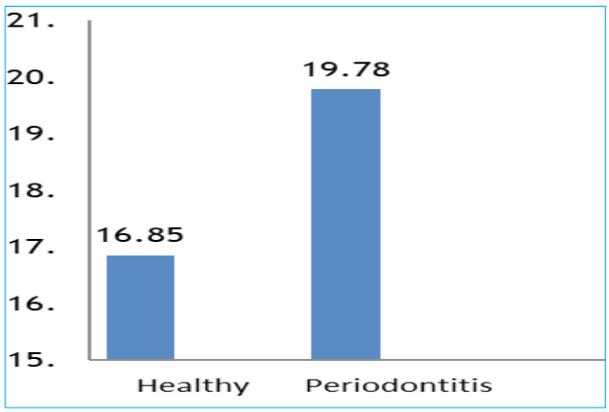

Figure 2. Mean Vitamin D level in health and chronic periodontitis groups.

Table 1. Mean vitamin D level according to age group.

Age group (Years)	N	Mean ng/mL	Std. Deviation	p-value
25-34	38	16.58	9.23	0.275
35- 44	30	19.13	12.77	
45 - 54	12	21.77	4.79	
Total	80	18.31	10.32	

DISCUSSION

The present study showed that there were no differences in the level of vitamin D between participants with healthy periodontium and chronic periodontitis. Chronic

periodontitis is caused by bacteria that stimulate the immune and inflammatory responses as part of the organism's defense mechanisms, and responses through Toll-like receptors are important in the pathogenesis of periodontal disease.[1]

Vitamin D has role in bone metabolism including anti-inflammatory activity.[2] 1,25(OH)D_3 is formed when microorganisms cause the activation of 1α-hydroxylase synthesis, which binds with the vitamin D receptor in the immune and epithelial cells and participates in epithelium defense mechanism against the pathogen. It stimulates the synthesis of antimicrobial peptides (ß-defensin and cathelicidin LL-37), which plays a role in chemotaxis, production of cytokines and chemokines, cellular reproduction, vascular permeability, wound healing, and neutralization of bacterial endotoxins.[10] Vitamin D suppresses the proliferation of T-lymphocytes, secretion of immunoglobulins, transformation of B-lymphocytes into plasma cells, and protects the organism from excessive specific immune response by decreasing the secretion of IL-1, IL-6, IL-8, IL-12, TNFα cytokines, which are released in periodontitis pathogenesis during a bacterial invasion and cause lymphocyte infiltration, bone resorption, deterioration of extracellular matrix[11] and due to this mechanism there may be relation between Chronic Periodontitis and Vitamin D deficiency.

The findings of present study was in contrast to the study done by Dietrich et al who had analyzed data from the third National Health and Nutrition Examination Survey (NHANES III) and reported that Vitamin D may reduce susceptibility to gingival inflammation through its anti-inflammatory effects, however the sample size is larger compared to the present study.[4] Milen et al in the study showed that vitamin D was inversely associated with gingival bleeding which shows acute gingival inflammation and clinical categories of chronic periodontal disease based on pocket depth but not associated based on measures of alveolar crestal height and tooth loss which supports the present study.[12]There was no association of the level of vitamin D and chronic periodontitis seen in the present study which is supported by the study done by Holick MF who had reported that around 1 billion people have vitamin D deficiency and it is not significantly related to the periodontal disease,[5] and also supported by Van der Putten et al in the systematic review concluded that there is no association between vitamin D deficiencies and periodontal disease in elderly people.[13] Other various studies also supported the present study as in study done by Zhan et al in Pomerania in Germany, which showed no association between incidence changes of clinical attachment loss (≥3 mm) and serum 25(OH)D baseline levels.[14]Antonoglou et al 2015 had shown no association between serum vitamin D level and periodontal condition measured as periodontal pocketing and gingival bleeding.[15] Systematic review by Pinto et al[16] reported inconclusive data to support the association between vitamin D levels and periodontal disease. Mahmood et al conducted study in Erbil city and reported no significant relationship between vitamin D deficiency and chronic periodontitis.[17] Bonnet et al reported vitamin D status was not associated with loss of attachment (LOA) at the bivariate level, but it was inversely associated with loss of attachment (LOA) at the multivariate level which provide modest evidence supporting a relation between low plasma 25(OH)D concentrations and periodontal disease.[18] In a recent published review by Milen et al reported that there is no strong evidence to suggest the association between vitamin D level and periodontitis which supports the present study.[19]

Various studies have shown the association of the level of vitamin D and periodontitis which is in contrast to the present study. Dietrich et al who had concluded that low serum 25(OH)D3 concentrations may be associated with periodontal disease which may be due to Vitamin D not only has effect on bone mineral density but also is said to have immunomodulatory effects that might alter the course of periodontal disease.[20] Antonoglou et al had reported significant association between serum 1,25(OH)2D level and periodontal health status which is contrast to the present study.[21] Laky et al had shown the association vitamin D deficiency and onset and progression of periodontal disease.[22]

Grant et al had reported hypovitaminosis D as a risk factor for periodontal disease meets Hill's criteria for causality in a biological system.[23] Farjana et al had reported that vitamin D deficiency as a risk for infectious and chronic inflammatory diseases like periodontitis, which is in contrast to the present study which does not show the association of vitamin D with chronic periodontitis.[24]

Radiographic bone loss would have confirmed presence of periodontitis and could have been used to check if any association between vitamin D levels and presence of periodontitis as in the Norwegian patients, [25] while in this study radiographic evaluation was not done. Vitamin D supplementation could have been given to see if any clinical improvement occurs in one group as done in other studies. [26,27] Krall et al showed that the supplement of calcium and vitamin D had a beneficial effect on tooth retention. These studies show the beneficial effect of vitamin D supplements.[28] Meghli et al reported that vitamin D supplements has multiple benefits for

reducing systemic inflammation and promoting induction of autophagy-related proteins related to anti-microbial functions, whereas no supplements were given in the present study.[29]

Amaral Bastos et al had reported that in patient with chronic kidney disease the level of vitamin D was associated with chronic periodontitis, and sufficient amount of vitamin D is needed for healthy periodontium, however in the present study patients involved were without any systemic disease.[2]

Studies had reported that the relationship between vitamin D receptor halotypes and periodontal disease.[3] Murthykumar et al had reported no association between vitamin D receptor polymorphism and chronic periodontitis, which supports the present study showing no association of vitamin D and chronic periodontitis, however vitamin D receptor polymorphism were not evaluated.[30]

The limitations of this study includes limited sample size, severity of chronic periodontitis was not compared with vitamin D level, patients in the healthy group included were more younger compared to chronic periodontitis group, post treatment evaluation was not done which could have been done to evaluate the relationship between improvement of clinical parameters and vitamin D level.

CONCLUSIONS

There are no differences in the level of serum vitamin D between healthy and chronic periodontitis groups. Further study with larger sample size is required to see if any association between vitamin D level and chronic periodontitis is present.

CONFLICT OF INTEREST

None

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