

Evaluation of Clinical Effect of Oral Vitamin D3 Supplementation in the Treatment of Chronic Periodontitis with Type 2 Diabetes Mellitus-A Randomized Controlled Trial

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Original Research Article

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Article History

Received: 02.10.2018

Accepted: 13.10.2018

Published: 30.10.2018

DOI:

10.21276/sjodr.2018.3.10.6



Abstract: To assess the clinical outcome of oral Vitamin D3 Supplementation in Type 2 Diabetes Mellitus patients with generalised chronic adult Periodontitis. A total of 92 subjects, comprising 46 in non diabetic and 46 in diabetic group were enrolled in the clinical trial according to the inclusion and exclusion criteria. Periodontal clinical parameter, Probing Pocket Depth (PPD) was assessed at baseline. Following initial examination Scaling and root planing was completed for all the subjects enrolled in the study and by cluster randomization first 25 subject subjects from each group were supplemented with oral vitamin D3 granules of 60,000IU once a week for 8 weeks following SRP. At the end of the study after 8 weeks, Probing Pocket Depth was reassessed. Significant improvement was seen in both interventions namely SRP +VITAMIN D and SRP alone .But marked reduction in PPD was seen in SRP+vitamin D supplemented group. Reduction in PPD was more for Non diabetic subjects when compared to Diabetic subjects. Vitamin D supplementation can be used as an adjunct to SRP for both diabetic and non diabetic patients with chronic periodontitis in vitamin D deficient subjects.

Keywords: Chronic periodontitis, type 2 diabetes mellitus, vitamin D supplementation, probing pocket depth, scaling and root planning.

INTRODUCTION

Periodontitis is described as a multifactorial irreversible and cumulative condition, initiated and propagated by bacteria and host factors. This interaction triggers a complex process of inflammatory events, which in turn promote connective tissue destruction and alveolar bone remodelling [1].

Low serum levels of vitamin D have been linked with a loss of periodontal attachment. Vitamin D serum concentrations might affect periodontal disease both through an effect on bone mineral density (BMD) and through immunomodulatory effects. The active metabolite of 25-hydroxyvitamin D, 1,25 dihydroxyvitamin D, has been found to inhibit cytokine production and cell proliferation [2].

Oral epithelial cells are capable of converting inactive Vitamin D to the active form of 25-hydroxyvitamin D (25(OH)D), which has been shown to induce expression of the antimicrobial peptide LL-37 and other host defense mediators. This may represent a mechanism by which Vitamin D enhances innate immune defenses against periodontal pathogenic bacteria. It also reduces the concentrations of matrix metalloproteinases and maintains oral health.

Hypovitaminosis D is a risk factor for periodontal disease which meets the criteria for causality in a biological system proposed by Hill [3].

Vitamin D deficiency also predisposes to hypertension, diabetes, the metabolic syndrome, left ventricular hypertrophy, congestive heart failure, and chronic vascular inflammation. Diabetes mellitus is a major risk factor in the occurrence of Periodontitis and vitamin D has been found to play a role in the development of chronic diseases such as Periodontitis and diabetes [4]. There is an emerging consensus that serum 25-OHD3 levels of above 30ng /ml are optimal for bone health and extra skeletal effects. In the USA, vitamin D is recommended at a dose of 50 000 IU/week for 8 weeks, irrespective of the degree of vitamin D deficiency or body weight [5].

The aim of this randomized controlled trial was to determine clinical effect of oral vitamin D supplementation as assessed by probing pocket depth in the treatment of chronic periodontitis with type 2 diabetes mellitus.

MATERIALS AND METHODS

This was a randomized, controlled, single blinded clinical trial based on the CONSORT 2010 guidelines carried out between March 2016 and June 2017 in the Division of Periodontics, Rajah Muthiah Dental College and Hospital, Annamalai University, Chidambaram. The research protocol was approved by the Institutional Human Ethical Committee (IHEC/0022/2015, dated 11.12.2015) before the initiation of the study. All the subjects were informed about the study and informed written consent were obtained prior to the onset of the study. Study groups were divided into non diabetic and diabetic groups with the following inclusion criteria:

Non Diabetic group

- Systemically healthy
- Moderate to severe forms of generalized chronic periodontitis subjects with PPD >5mm, and CAL >3mm as a whole were included in both the groups.
- male subjects in the age group of 35 to 60 years
- Serum Vitamin D levels <30 ng/mL.
- Minimum of 20 teeth to be present.
- Patients with good compliance.

Diabetic Group

- Mild to moderately controlled type 2 diabetes mellitus with HBA1C level (less than 8) ,
- Moderate to severe generalized chronic periodontitis subjects with PPD >5mm, and CAL >3mm.
- Otherwise systemically healthy subjects with FBS> 126 mg/dl
- Duration of diabetes not less than 5 years
- Other criteria mentioned in non diabetic group were included.

Female subjects were excluded to avoid hormonal influence, Chronic Smokers, Alcoholics,

Smokeless tobacco users, Subjects with acute illnesses/acute intraoral lesions. Subjects with chronic systemic diseases other than Type 2 diabetes mellitus, Patients with aggressive periodontitis, History of habits, drugs, systemic factors that would influence the outcome of the study, any form of periodontal treatment before 6 months which might influence the outcome of the study were also excluded from the study.

Study design

A total of 92 subjects, comprising 46 in non diabetic and 46 in diabetic group were enrolled in the clinical trial according to the inclusion and exclusion criteria. Probing Pocket Depth using william’s periodontal probe with markings at 1,2,3,5,7,8,9 and 10 millimeters from existing gingival margin to the base of the gingival sulcus/pocket was measured as the distance from the gingival margin to the base of the pocket at six sites (distofacial, midfacial, mesiofacial, mesiolingual, midlingual and distolingual surfaces) in each tooth [6] was assessed at baseline. Following initial examination Scaling and rootplaning was completed for all the subjects enrolled in the study and by cluster randomization first 25 subjects from each group and were supplemented with oral vitamin D3 granules of 60,000IU once a week for 8 weeks following SRP. At the end of the study after 8 weeks, Probing Pocket Depth was reassessed.

STATISTICAL ANALYSIS

Data thus obtained were recorded in a proforma, tabulated and subjected to the following statistical analysis:

- T-Test: Baseline parameters were compared using t-test.
- 2x2 repeated measures anova test was used to find the effectiveness of vitamin D supplementation.
- and also to assess whether the glycemic status influence the outcome of treatment on chronic periodontitis subjects
- 2x2 repeated measures ANCOVA (Analysis Of Covariance)test:

RESULTS

Table-1: Mean and SD of PPD group wise at baseline (mm)

Variable	Non diabetes		Diabetes		T value	P-value
	Mean	SD	Mean	SD		
PPD	6.9	0.60	8.39	0.75	10.4	<0.001

At baseline the mean PPD were found to be different in both the group study, 6.9 mm for non diabetics group and 8.39 mm for diabetic group. The mean value was compared by T test and P value was

found to be significant (<0.001).This indicates that the PPD was considerably maximum in diabetic group as compared to non diabetic group.

Table-2: Mean and SD of reduction in PPD by treatment wise and group wise (mm)

Group	SRP+Vitamin D		SRP	
	MEAN	SD	MEAN	SD
NDM	3.9	0.55	5.8	0.70
DM	6.2	0.81	6.8	0.79

After intervention with SRP +vitamin D the mean PPD reduced to 3.9 mm with SD 0.55 for NDM subjects and 6.2mm with SD 0.81 for DM subjects. Whereas for SRP alone the mean PPD reduced to 5.8

mm with SD 0.7 and 6.8 mm with SD 0.79 for NDM and DM subjects respectively.

SRP +vitamin D treated subjects had higher reduction when compared to the subjects treated with SRP alone.

Table-3: Comparison of PPD between SRP alone and SRP+VIT D at the end of 2nd month using ANCOVA

Source	F -value	P-value
PPD at baseline	158.6	0.001
Group	8.5	0.004
Treatment	253.2	0.001
Group x treatment	16.3	0.001

Table-3 shows the Comparison of between SRP alone and SRP+VIT D, done at the end of 2nd month using ANCOVA

Since at baseline the PPD was different between NDM and DM subjects ANCOVA test was carried out after controlling baseline variations.

Significant p 0.001 value of comparison "Group x treatment" infers that PPD at the end of 2nd month has been statistically different for those treated with SRP alone and SRP+ vitamin D Supplementation.

Further the PPD has been highly influenced by glycemic status of the subjects. For the DM subjects the PPD has been slightly higher than NDM.

Covariant

Significant PPD at baseline indicates both the treatment was highly influenced by the initial PPD.

DISCUSSION

One billion people worldwide have vitamin D deficiency or insufficiency. Low intake of vitamin D and calcium may lead to negative calcium balance, thus causing a secondary increase in calcium removal from bone, including alveolar bone. Such bone loss may contribute to weakening of tooth-attachment apparatus. In addition to its action on skeletal homeostasis, vitamin D and in particular its hormonally active form, 1, 25 dihydroxy vitamin D, has anti-inflammatory and anti-microbial effects via modulation of inflammatory cytokine production by immune cells and stimulated secretion of peptides with anti-bacterial action by cells of monocyte-macrophage lineage. These multiple actions of vitamin D are potentially appealing for the management of patients with periodontal disease, whose pathogenesis is based on chronic bacterial driven inflammation. The inflammatory response leads to tissue destruction by direct action of bacterial products

or by activation of host defence cells and secretion of inflammatory mediators. These locally produced factors eventually result in connective tissue breakdown and bone loss via activation of osteoclast mediated bone resorption [7].

Recent clinical practice guidelines also recommend 50,000-70,000 IU/week Vitamin D oral supplementation for 8 weeks in case of Vitamin D deficiency. The guidelines also recommend maintaining 25(OH) D blood levels with daily 1500–2000 IU [8].

Vitamin D has been proposed to play an important role and to be a risk factor in the development of insulin resistance and the pathogenesis of type 2 DM by affecting either insulin sensitivity or β -cell function, or both [9].

In our study the baseline PPD level was more in diabetic group ($p < 0.001$). Likewise a study done by Botero *et al.*, [10] found that in Diabetes patient with periodontitis loss of periodontal clinical attachment was greater when compared to patients without diabetes. Furthermore, diabetes patients with periodontitis presented higher glycemic and glycated hemoglobin values in contrast to patients with gingivitis. There were statistical differences for glycemic values, probing pocket depth and CAL among all the groups ($P < 0.01$). This study contributes additional evidence that diabetes could aggravate periodontal disease and affect the systemic health of individuals [10].

In our study a significant ($p < 0.001$) reduction was seen PPD following SRP at the end of 8th week. This was in accordance with a study conducted by mahendra mohan [11] to evaluate the impact of scaling and root planing (SRP) in chronic periodontitis patients with type 2 diabetes mellitus (T2DM-CP) or without type 2 diabetes mellitus (NDM-CP). The results showed

that SRP resulted in statistically significant improvement in periodontal health parameters (PI, GI, PPD, CAL).

In our study a statistically significant reduction ($p < 0.001$) in probing pocket depth (PPD) was seen after 8 weeks of vitamin D supplementation. This was in accordance to a clinical trial done by Garcia M *et al.*, [12] who studied the effect of vitamin D supplements on periodontal clinical parameters compared to patients not taking supplementation and results showed that Calcium and vitamin D supplementation ($\leq 1,000$ IU/day) had a modest positive effect on periodontal health.

This was also in accordance to a nonrandomised clinical trial conducted by Jayachandran Perayil [13], who evaluated the effect of vitamin D and calcium supplementation in reducing gingival inflammation, using clinical periodontal parameters and concluded that vitamin D supplementation has got a positive effect on periodontal health and it can be used as an adjunct to non surgical periodontal therapy.

Similar Clinical studies done by Nilofer Farjana [14], Miley DD *et al.*, [15] Hiremath [16] also concluded that vitamin D supplementation improves periodontal health.

CONCLUSION

According to this study, superior results was obtained using oral vitamin D supplementation as an adjunct to SRP as compared to subjects treated with SRP alone. Thus Vitamin D supplementation has got a positive effect on periodontal health and it can be used as an adjunct to SRP in vitamin D deficient chronic periodontitis patients with and without type 2 diabetes mellitus.

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