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Vitamin D and calcium supplementation effects on chronic periodontitis: A Cross-sectional study

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Abstract

Background: Vitamin D and calcium deficiency in the diet accelerate bone loss and osteoporosis. We investigated if taking vitamin D and calcium supplements impacts periodontal disease status since vitamin D metabolites may alter the inflammatory response and have antimicrobial effects.

Methods: A total of 51 patients were recruited from two dental clinics who were getting periodontal maintenance therapy. 23 of them were taking vitamin D (400 international units/day) and calcium (1000mg/day) supplements, while the remaining 28 were not. All of the participants experienced clinical attachment loss of 3 mm at two interproximal locations. Nutritional analysis was used to estimate daily calcium and vitamin D intakes (from food and supplements).

Results: Supplement users exhibited shallower probing depths, fewer bleeding sites, lower gingival index values, fewer furcation involvements, less attachment loss, and less alveolar crest height loss than those who did not take vitamin D and calcium supplements. The differences in clinical indicators were borderline significant (P=0.08), according to the repeated-measures analysis.

Conclusion: In these subjects receiving periodontal maintenance therapy, there was a trend for better periodontal health with intake of vitamin D and calcium supplementation. More expanded longitudinal studies are required to determine the potential of this relationship.

Keywords: alveolar bone; calcium; chronic periodontitis; vitamin D

Introduction

Although not commonly acknowledged, most epidemiological data imply that alveolar bone loss is greater in patients with low bone mass or osteoporosis, [1-4]. Chronically low vitamin D and calcium intakes are likely to cause a negative calcium balance, resulting in an increase in calcium removal from bone, including the alveolar bone [5, 6]. The tooth attachment system may become weaker as a result of this bone loss. Vitamin D, and particularly its hormonally active form, 1,25-dihydroxyvitamin D, exerts anti-inflammatory and antimicrobial actions via modulating inflammatory cytokine production by immune cells and stimulating release of antibacterial peptides by monocyte macrophage cells. [7-12] Vitamin D's numerous activities could be beneficial in the treatment of individuals with periodontal disease, which is caused by chronic bacterial-driven inflammation. The inflammatory response causes tissue destruction either through direct bacterial product action or through activation of host defense cells and inflammatory mediator release. By activating osteoclast-mediated bone resorption, these locally generated substances eventually result in connective-tissue degradation and bone loss. [13, 14].

The general population's vitamin D and calcium intakes are below the current guidelines of 400-600 IU and 1000-1200 mg daily, respectively. [15] Although there is a growing consensus that such daily objectives are inadequate, and professional organizations now recommend higher vitamin D doses (800-1000 IU daily), [16] it is estimated that one billion individuals worldwide have vitamin D deficiency or insufficiency. [17, 18] While the benefits of calcium and vitamin D supplements on bone health are well known, their potential impact in periodontal disease has yet to be fully elucidated. Several studies have found that supplementing with vitamin D and/or calcium reduces alveolar bone loss, gingival inflammation, and/or attachment loss. [22] The goal of our research was to see if taking calcium and vitamin D supplements orally by people in periodontal disease maintenance programmes had an effect on clinical periodontal health markers.

Materials and Methods

The subjects for this cross-sectional, observational study were recruited from the department of Periodontics at Maharishi Markandeshwar University in Ambala, India, between September 2021 and February 2022. The Institutional Review Board Committee gave their approval to the project. For involvement in the study, all

subjects signed informed consent agreements. They were periodontal maintenance patients who got routine maintenance therapy.

Twenty three subjects who had been taking vitamin D (400 international units/day) and calcium (1000 mg/day) supplements for more than 18 months ("takers") and 23 subjects who had dietary intakes of calcium (1000 mg/day) and vitamin D (400 international units/day) but were not taking either vitamin D or calcium supplementation ("nontakers") were enrolled in the study. At their baseline consultations, subjects were asked to bring their bottles of oral supplementation and how long they had been taking them. Subjects have previously completed questionnaires approved by the institutional review board to establish their levels of oral supplementation.

A minimum of one maxillary and two mandibular posterior teeth were required, as well as moderate to severe chronic periodontal disease (two interproximal locations with 3 mm or more clinical attachment loss). We recruited postmenopausal women (those who haven't had a period in the last 5 years) and men aged 50 to 80.

Gingival index, probing depth 46, cementoenamel junction-gingival margin distance (CEJ-GM) (attachment loss), bleeding upon probing, and furcation involvement were all reported as periodontal metrics. For each mandibular posterior tooth, clinical measurements were taken at six different locations (buccal, lingual, mesiolingual, mesiobuccal, distolingual, and distobuccal). At the chairside, all clinical data was input onto computerized forms. The operator and the reference standard examiner measured five representative participants twice as part of the calibration technique. When the operator obtained at least 80% intra- and inter-examiner exact repeatability, as well as 95% intra- and inter-examiner reproducibility, she was considered calibrated for the gingival and furcation indices. The mandibular posterior teeth were photographed with photostimulable-phosphor bitewing radiography.

All measurements, including vitamin D and calcium intakes, were given mean values and 95% confidence intervals. For each clinical measurement, the Student's t test was employed to see if there were any differences between takers and non-takers.

Results

Despite the fact that none of the subjects in the non-taker group took calcium or vitamin D supplements, a thorough dietary analysis indicated that five of them had calcium intakes of more than 1000 mg/day and one had a vitamin D consumption of more than 400 IU/day. These participants were kept in the non-taker group, but 5 additional non-taker subjects who matched all of the enrollment criteria were added to the non-taker group. Furthermore, one person using oral calcium supplements had a total calcium consumption of only 897 mg per day. In the taker group, this subject was kept. The total number of subjects in the study was 23 in the taker group and 28 in the non-taker group. The average age of the takers was 63.9 years old (61.1-66.7 years). The non-taker group had an average age of 62.0. (58.4-65.7 years). For both groups, Table 1 presents demographic data on gender and smoking history.

When comparing patients who did not take oral supplementation to those who did, the mean scores for all clinical measurements of periodontal health were higher in those who did not. In patients who did not take oral supplements, probing depths, attachment loss, and CEJ-AC distances were 7 percent (0.15 mm/2.18 mm), 12 percent (0.21 mm/1.80 mm), and 19 percent (0.32 mm/1.71 mm) higher, respectively. The additional clinical measurements revealed similar variances. None of the univariate test findings for the clinical measurements were meaningful due to the relatively substantial standard deviations (Table 2)

Table 1: Demographic Data

	Taker n (%)	**Non-taker n (%)**	**Total n (%)**
Gender			
Male	6(13)	16(31)	22(44)
Female	17(33)	12(23)	29(56)
Total	23(46)	28(54)	51(100)
Smoking			
Smoker	1(2)	1(2)	2(4)
Non- smoker	16(33)	20(38)	36(71)
Past smoker	6(12)	7(13)	13(25)
Total	23(46)	28(54)	51(100)

Table 2: Mean values and 95% confidence intervals for clinical and radiographic measurements plus total calcium and vitamin D intakes

Measurement	**Taker (n=23)**	**Non-taker (n=28)**
Probing depth	2.18 (2.00-2.36) mm	2.33 (2.09-2.57) mm
Attachment level	1.80 (1.39-2.20) mm	2.01 (1.59-2.42) mm
Bleeding	60 (52-69) %	66 (58-74) %
Gingival Index	0.73 (0.52-0.94)	1.00 (0.77-1.23)
Furcation Involvement	47 (26-68) %	72 (42-100) %

CEJ-AC	1.71 (1.34-2.09) mm	2.04 (1.63-2.45) mm
Calcium intake	1769 (1606-1933) mg/day	642 (505-779) mg/day
Vitamin D intake	1049 (781-1317) IU/day	156 (117-195) IU/day

Discussion

We were able to enroll two groups of participants who were substantially distinct from one another based on dietary analysis and a positive or negative history of calcium and vitamin D administration. We encountered trouble finding individuals who were taking enough oral supplements to meet our inclusion criteria, which is likely due to the fact that only a small percentage of the general population meets the dietary requirements for these nutrients. These guidelines are ostensibly sufficient for preventing osteomalacia in adults, but they were not developed to ensure the favorable effects of vitamin D reported in this paper [23]. In fact, it's been estimated that vitamin D3 doses of 3,800 to 5,000 IU/day are needed to ensure that vitamin D deficiency or insufficiency is addressed in more than 80 percent of people. [24-26]

In our patient pool, we made a concentrated effort to select takers with the highest levels of vitamin D oral supplementation. Our efforts resulted in a mean total vitamin D consumption of 1049 IU/day (diet + supplements), with just three subjects consuming more than 2000 IU/day. The average daily total calcium consumption in the takers group was 1769 mg, which was more than the current standard; however, the average daily calcium intake in the non-takers group was only 642 mg, which was considerably below the current requirements. It's also possible that our two groups' exposure to sunlight (which leads to vitamin D production) differed; however, the groups were well balanced throughout the enrollment period, so seasonal variations in sunlight exposure are unlikely to have influenced them differentially.

When comparing patients who did not take oral supplements to those who did, all periodontal indicators were higher (worse) in those who did not. It's possible that participants who take dietary supplements on a regular basis are more health-conscious than those who don't, and that the variations in periodontal health metrics reflect improved overall health. This possibility cannot be ruled out; however, all of the participants in our study were in good health and had been enrolled in periodontal-maintenance programmes for at least six months, receiving regular treatments that appeared to be effective, as they had attachment loss of less than 2 mm on average. As a result, they were all highly driven to maintain proper dental hygiene.

The attachment loss and alveolar crest height loss measurements in our investigation were similar, despite the fact that attachment loss measurements should be less than alveolar crest height loss data. We discovered that several of our individuals had significant buccal attachment loss, but that this buccal attachment loss was not represented in our alveolar-crest-height measures.

As a result, our findings imply that vitamin D and calcium supplementation could be recommended as part of periodontal disease care, despite the limitations of a cross-sectional design in a small sample. To establish the potential of this link, further extensive longitudinal investigations are needed.

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