

EVALUATION OF THE EFFECT OF VITAMIN D ON THE COURSE OF INFLAMMATORY PERIODONTAL DISEASES

Oxunjonova Xayotxon Xosilovna

Andijan State Medical Institute, Uzbekistan

Annotation: Vitamin D is seco steroid, a fat soluble vitamin with hormone like action playing key role in calcium and phosphorus homeostasis an metabolism of bone. Vitamin D plays a significant role in bone remodelling and plays a crucial role in both bone mineralisation and demineralisation. The primary source of vitamin D is from 7- dehydrocholesterol during a photochemical reaction under the effect of ultraviolet radiation on the skin, in addition diet and nutritional supplements also contribute to vitamin D.

Key words: Vitamin D, Covid-19, osteoporosis, osteomalacia.

Vitamin D increases the intestinal absorption of calcium and decreases the secretion of parathyroid hormone, which consequently decreases systemic bone resorption. In addition, vitamin D stimulates osteoblastic bone production and alkaline phosphatase activity, optimizes bone remodeling and covers bone mass by increasing bone matrix proteins [1,2] Vitamin D deficiency causes rickets, osteopenia, osteoporosis, osteomalacia and in chronic cases it leads to hypertension, autoimmune diseases, certain cancers, type I diabetes, cardiovascular diseases, secondary hyper parathyroidism. In recent studies serum Vitamin D levels has been found to have potential benefits for COVID-19 and in assessing patients' potential of developing severe COVID-19[3,4] . Lower vitamin D levels are also associated with higher periodontal destruction and severe periodontitis stage[5]. Therefore, the present study is aimed to examine the role of vitamin D in periodontitis.

Vitamin D is seco steroid, a fat soluble vitamin with hormone like action playing key role in calcium and phosphorus homeostasis an metabolism of bone. Vitamin D plays a significant role in bone remodelling and plays a crucial role in both bone mineralisation and demineralisation. The primary source of vitamin D is from 7- dehydrocholesterol during a photochemical reaction under the effect of ultraviolet radiation on the skin, in addition diet and nutritional supplements also contribute to vitamin D. Vitamin D increases the intestinal absorption of calcium and decreases the secretion of parathyroid hormone, which consequently decreases systemic bone resorption. In addition, vitamin D stimulates osteoblastic bone production and alkaline phosphatase activity, optimizes bone remodeling and covers bone mass by increasing bone matrix proteins [1,2] Vitamin D deficiency causes rickets, osteopenia, osteoporosis, osteomalacia and in chronic cases it leads to hypertension, autoimmune diseases, certain cancers, type I diabetes, cardiovascular diseases, secondary hyper parathyroidism. In recent studies serum Vitamin D levels has been found to have potential benefits for COVID-19 and in assessing patients' potential of developing severe COVID-19[3,4] . Lower vitamin D levels are also associated with higher periodontal destruction and severe periodontitis stage[5]. Therefore, the present study is aimed to examine the role of vitamin D in periodontitis.

It was estimated that 1 billion people worldwide have vitamin D deficiency or insufficiency [2]. 70 - 100% of the general population all over India bear Vitamin D deficiency. [6]. From the study made by Al Zarooni [7] we can observe that Vitamin D deficiency was similar in both male and female (male 83.1%, female 83.8%) as insufficiency (male 12.7%, female 11.2%)[43] and Al Quaiz

[8]stated that, younger adults and males are more prone to vitamin D deficiency than the older participants and females .On examining few surveys it's found that Vitamin D deficiency is more among illiterate and non-working women than the literate and working women[9] Scientific evidences supporting vitamin D deficiency in India even among medical fraternity is reported [10,11]

METABOLISM OF VITAMIN D: The two significant forms of vitamin D are: Vitamin D₂ or ergocalciferol and Vitamin D₃ or cholecalciferol. Vitamin D₂ or ergocalciferol is synthesized through the irradiation of ergosterol in the presence of UV light in plants, yeasts and mushroom. UVB irradiation of 7 - dehydrocholesterol, which is an intermediate of cholesterol synthesis, found in malpighian layer of epidermis give rises to secosterol, in which the cis double bond is isomerised to trans bond leading to the formation of Vitamin D₃ or cholecalciferol that is hydroxylated to 25-hydroxycholecalciferol in the liver, which in turn is hydroxylated in kidney to form an active form of vitamin D known as Calcitriol (1, 25-dihydroxycholecalciferol). [12]

BONE MINERALIZATION AND RESORPTION UNDER THE INFLUENCE OF VITAMIN D: Vitamin D helps to attune skeletal integrity and mineral homeostasis through intestinal, bone, and renal resorption .From the review of Dr. Michael F. Holick we can perceive that decreased serum levels of 25-hydroxyvitamin D, significantly reduces the intestinal absorption of calcium that is associated with increased parathyroid hormone which activates osteoblasts, and stimulates the transformation of pre osteoclasts into mature osteoclasts that can dissolve the mineralized collagen matrix in bone. Thus, intensifying the bones to lose their density and hardness by constant release of calcium into the bloodstream. Bone is resorbed by osteoclasts, and is deposited by osteoblasts by the process called ossification. Receptor activator of nuclear factor kappa-B ligand (RANKL) and Osteoprotegerin [OPG](RANKL antagonist) are produced by osteoblasts and other cells such as activated CD4 + T lymphocytes to regulate the bone remodelling. Binding of RANKL to RANK results in the differentiation of osteoclast progenitor cells into mature osteoclast. These mature osteoclasts remove calcium and phosphorus from the bone, maintaining calcium and phosphorus levels in the blood. Whereas, OPG (osteoprotegerin) acts as a soluble receptor for RANKL, inhibiting RANK-RANKL interaction and the maturation of osteoclast progenitor cells. Therefore, the mature osteoclast formation is determined by the relative ratio of RANKL to OPG in the osteoclast precursor microenvironment. The RANKL gene promoter contains vitamin D and glucocorticoid response elements. Studies have shown that vitamin D-VDR stimulates RANKL expression in cells such as osteoblasts and bone marrow-derived stromal cells. Vitamin D down regulates OPG, increased RANKL expression and decreased expression of OPG caused by vitamin D would favour the differentiation and activation of osteoclasts that eventually causes increased bone resorption. However, Hofbauer et al. stated a sparking effect of vitamin D on OPG, and Kondo et al. stated that vitamin D initially represses OPG, but long-term exposure to vitamin D leads to a recovery of OPG expression. This suggests that the catabolic effects of vitamin D can be ephemeral. Anabolic effects of vitamin D on osteoblasts, includes stimulation of osteopontin and alkaline phosphatase Vitamin D has a significant role in the modulation of the immune system, inflammation system and ossification process. All these characteristics show significant associations between periodontal health and intake of vitamin D.A study by Madi et al has shown that vitamin D status is found to be positively correlated with periodontal health in a Saudi population [37] . various studies done by several authors shows a positive association between vitamin D status and periodontal health correlating serum and salivary levels of VitD with pocket depth and alveolar bone loss [5,22,35,36]. A study Dietrich et al has shown the relationship between serum levels of Vitamin D and periodontal inflammation [33].

Nathalia Gracia et al in a systematic review as concluded that there is probably little correlation between vitamin and periodontitis [38]. Also, study by Zhan et al contradicts the role of vitamin D in periodontal health [39]. In spite of the perplexing reports available vitamin D is considered as a nutraceutical component playing a key role in periodontal health. The most important characteristics of vitamin D in periodontal health are reported as follows.

ANTI-INFLAMMATORY PROPERTY OF VITAMIN D IN PERIODONTAL HEALTH: It is far and wide known that periodontitis is a chronic host mediated response causing periodontal destruction by the release of pro - inflammatory cytokines by local tissues and immune cells in response to the bacteria of dental plaque and their products and metabolites which results in destruction of connective tissue and alveolar bone. Vitamin D has anti-inflammatory properties that can inhibit the inflammatory cytokines and makes the monocyte/macrophages to secrete molecules that have a strong antibiotic effect.

References:

1. Shaili Pradhan, Shweta Agrawal - Serum Vitamin D in Patients with Chronic Periodontitis and Healthy Periodontium. J Nepal Health Res Counc 2020 Oct-Dec; 18(49): 610-4.
2. Muhammad Nazir , Asim Al-Ansari, Khalifa Al-Khalifa, Muhanad Alhareky, Balgis Gaffar , and Khalid Almas - Research Article Global Prevalence of Periodontal Disease and Lack of Its Surveillance. Hindawi Scientific World Journal Volume 2020, Article ID 2146160,
3. R. Mathangi, Vidhyarani Shyamsundar , S. Shila Immunohistochemical evaluation of bone morphogenetic protein 3 in chronic periodontitis influenced by Type 2 diabetes mellitus .Drug Invention Today 2020; 14 (1) :91-94.
4. Bashutski JD, Eber RM, Kinney JS et al. Teriparatide and osseous regeneration in the oral cavity. N Engl J Med 2010;363:2396–2405.
5. Batuhan A. Bayirli, Ayla Öztürk, Bahattin Avci - Serum vitamin D concentration is associated with antimicrobial peptide level in periodontal diseases. Archives of Oral Biology 2020;117: 104827.
6. Liu K., Meng H., Hou J. Activity of 25- hydroxylase in human gingival fibroblasts and periodontal ligament cells. PLoS ONE. 2012;7:e52053.
7. Bikle D.D. Vitamin D and the immune system: Role in protection against bacterial infection. Curr. Opin. Nephrol. Hypertens. 2008;17:348–352.
8. McMahon L., Schwartz K., Yilmaz O., Brown E., Ryan L.K., Diamond G. Vitamin D-mediated induction of innate immunity in gingival epithelial cells. Infect. Immun. 2011;79:2250–2256.
9. Dietrich T, Joshipura KJ, Dawson-Hughes B, Bischoff-Ferrari HA. Association between serum concentrations of 25 - hydroxyvitamin D3 and periodontal disease in the US population 1-3. Am J Clin Nutr 2004; 80:108-13.
10. Sari DK, Sari LM, Laksmi LI, Farhat. The Moderate Correlation Between 25(OH)D Serum and Saliva in Healthy People with Low Vitamin D Intake. Int J Gen Med. 2021;14:841-850. Published 2021 Mar 11. doi:10.2147/IJGM.S302912
11. Anand N, Chandrasekaran SC, Rajput NS. Vitamin D and periodontal health: Current concepts. J Indian Soc Periodontol 2013; 17:302-8.

12. Sharma H, Arora R, Bhatnagar MA. Reconnoitering the relationship between “The sunshine Vitamin” and periodontal disease. J Oral Res Rev 2017; 9:89-95.
13. M. Madi, V. Pavlic, S. MongithAlammar, L. Mohammed Alsulaimi, R. Shaker Alotaibi, G. Mohammed Al Otaibi, O. Zakaria, The association between vitamin D level and periodontal disease in Saudi population, a preliminary study, The Saudi Dental Journal (2020).
14. Nathalia Garcia, Charles F. Hildebolt - Review Analysis and Evaluation // Etiology/Other Limited Evidence Suggests that Vitamin D May Help Prevent and Treat Periodontal Disease in Adults. Journal of Evidence Based Dental Practice . 2019.
15. Zhan Y, Samietz S, HoltfreterB,Hannemann A , Meisel P, Nauck M et al. Prospective study of serum 25-hydroxy vitamin D and tooth loss. J Dent Res. 2014;93:639-44.
16. Vickram, A. S., Srikumar, P. S., Srinivasan, S., Jeyanthi, P., Anbarasu, K., Thanigaivel, S., ... & Rohini, K. (2021). Seminal exosomes—An important biological marker for various disorders and syndrome in human reproduction. Saudi journal of biological sciences, 28(6), 3607-3615.
17. R Mathangi, B Jayaraman, N Geethapriya, A Venkatesh, S Samuel. The impact of chronic periodontitis on glycemic control and serum lipids in comparison with periodontal health.Journal of Dental Research and Review 7 (4), 159.