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The Level of 25-Hydroxy Vitamin D3 in Gingival Crevicular fluid and Serum Pre-Post Scaling and Root Planning in Chronic Periodontitis Patients in Western Libya: Comparative Study

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Abstract

Despite the critical role of vitamin D in the body, it can be affected by several factors that may cause deficiency and imbalances in vitamin D levels. The study aimed to evaluate 25-Hydroxy vitamin D3 in chronic periodontitis patients. The total study participants were 40 patients. They were divided into (20) as a study group with moderate to severe chronic periodontitis, and (20) chronic gingivitis patients were chosen as a control group. Gingival crevicular fluid and serum samples were collected at baseline and six weeks after therapy for the study group and at baseline for the control group. Systemic and local levels of 25-hydroxy vitamin D3 were measured using an enzyme-linked immunosorbent assay (ELISA) technique. The study group of diseased patients received initial periodontal therapy (SRP). The study showed that respective local 25-Hydroxy vitamin D3 levels significantly increased from baseline up to six weeks after (SRP) (3.41ng/ml versus 4.57ng/ml), *P*=0.022. The respective systemic 25-Hydroxy vitamin D3 levels significantly increased after six weeks from SRP (39.88ng/ml versus 41.48 ng/ml), *P*=0.001.

Keywords: Chronic periodontitis, 25-Hydroxy Vitamin D3, Libya.

INTRODUCTION

Current knowledge about the pathogenesis of periodontal disease suggests that its central cause is the loss of a healthy balance between microbial virulence agents and host inflammatory response(Amano, 2010; Genco, 1992; Lee et al., 2000). The immune system, while protecting the host against microbial dental plaque, also participates in attacking the host. Inflammation and tissue destruction are early and mediated processes in response to bacterial infection (Hauschka et al., 1989; Kornman et al., 1997 ; Madianos et al., 2005). Periodontal diseases may differ in their etiological factors and pattern of progression. This variability can be attributed to differences in the presence of factors that might modify the host response to microbial pathogens. Chronic periodontitis (CP) and aggressive periodontitis, forms of inflammatory periodontal disease, differ from each other in terms of the magnitude, sequel, and control of the response (Armitage, 2004) 5. The destruction of soft and hard tissues seen in periodontitis is caused by a large number of cytokines as well as due to the presence of other effects or molecules released by resident and migrating cells (Genco, 1992; Koide et al., 2010) .

Calcium-binding protein of bone accounts for 10–20% of the non-collagenous protein in bone matrix. It has three residues of a calcium-binding amino acid, gamma-carboxyglutamic acid (Gla), that allow specific conformational changes enabling its binding to hydroxyapatite and later accumulation in bone matrix (Hauschka, 1986; Lee et al., 2000).

Vitamin D plays a critical role in mediating calcium absorption and regulating musculoskeletal health (Giovannucci et al., 2008). It has also been demonstrated to function in the regulation of cardiovascular health, immune responses, wound healing, and cancer prevention (Kilkkinen et al., 2009). Vitamin D is a fat-soluble vitamin obtained from three sources. Endogenous synthesis of vitamin D occurs in the skin and is induced via ultraviolet radiation. It may also be obtained exogenously through dietary sources that include oily salt-water fish (mackerel, salmon, sardines, and tuna), cod liver oil, and egg yolk. Many countries, including the United States of America, fortify dairy products with vitamin D due to its scarcity in natural foods(Gorham et al., 2007; Kilkkinen et al., 2009). The aim of this study was to evaluate the level of 25-Hydroxy vitamin D3 in gingival crevicular fluid, serum pre-post scaling and root planning in chronic periodontitis patients.

MATERIALS AND METHODS

The present study was an analytical case control study, carried out on 40 patients whose ages ranged from 35-60 years (both males and females) and were selected from Surman Hospital dental department, dental clinic, Western Libya from Feb 2022 to May 2022. Only 20 patients were diagnosed as having chronic periodontitis after obtaining a proper case history and thorough clinical examination. 20 have been suffering from chronic gingivitis.

Participants:

The selected patients were (40), free from any systemic disease, and no medication had been received for three months prior to the study. Furthermore, none of them had previous periodontal treatment including scaling, root planning, and periodontal surgery in the last six months. On the other hand, smokers and pregnant females were excluded from the study**.** Verbal informed consent was taken from each participant in the study.

The clinical parameters were measured before and after treatment (at baseline, after 6 weeks), bleeding on probing index, plaque index, gingival index, clinical attachment level, and probing pocket depth.

Statistical analysis:

Data were presented as mean and standard deviation (SD) values. Data were presented as frequencies (n) and percentages (%). The chi-square (*x2*) test was used to compare between the two groups. The significance level was set at $P \leq 0.05$ by using the Statistical Package of Social Science SPSS, Version 20.

Ethical consideration:

The study was conducted at the University of Sabratha according to standards of ethics for scientific research. All participants provided verbal consent prior to participation.

RESULTS

Table 1 shows the demographic characteristics and baseline data of the patients enrolled in the study. The mean value and standard deviation of the age of individuals was 40.8 ± 7.7 years in

the study group. Their age ranged from 35-56 years, and 35.3 ± 3.4 were in the control group, their age ranged from 30-43 years.

Table (1). Shows Mean demographic characteristic data (age).

Parameters	Control Group (M±SD)	Study Group (M±SD)
Age (years)	30 – 43	35 - 56
Mean	35.3±3.4	40.8±7.7
Numbers	20	20

Table 2 shows the variation of mean values and standard deviation of GI, PI, BOP, PD, and CAL of individuals who participated in the study. For the study group, the mean value and standard deviation of the gingival index (GI) at baseline was 1.88 ± 0.29, and after SRP, it was 0.72 ± 0.22. Thus, there was a statistically significant decrease in GI values post-operatively ($P < 0.001$). Moreover, the mean value and standard deviation of plaque index (PI) before treatment was 2.02 ± 0.44. After treatment, the mean value was 0.72 ± 0.28. So, there was a highly statistically significant decrease between values of PI before and after treatment in the study group ($P < 0.001$).

It was observed that there was a statistically significant reduction in bleeding on probing (BOP) scores at baseline in the study group with mean values of 0.91 ± 0.08 compared to scores after treatment which was 0.18 ± 0.09 ($P < 0.001$). The mean value and standard deviation of probing pocket depth (PD) at baseline in the study group was 5.27 ± 0.77 mm and after therapy, it was 4.35 ± 0.73 mm. As a result, there was a statistically significant decrease in mean PD post-operatively ($P < 0.022$). Moreover, the mean value and standard deviation of clinical attachment level (CAL) at baseline in the study group was 5.84 ± 0.79 mm. After treatment, the mean value and standard deviation of CAL in the same group was 5.02 ± 0.71 mm. Therefore, in periodontitis patients; there was a statistically significant decrease in mean CAL post-operatively ($P < 0.033$).

Table (2). The mean values (SD) of GI, PI, BOP, PD, and CAL of the study and control group before and after (SRP).

Parameter	Before (Baseline)	After (SRP)	*P*-Value
GI	1.88±0.29	0.72±0.22	0.001
PI	2.02±0.44**	0.72±0.28	0.001
BOP	0.91±0.08*	0.18±0.09	0.00
PD	5.27±0.77	4.35±0.73	0.022
CAL	5.84±0.79	5.02±0.07	0.033

* Highly Significant ($P < 0.001$).
GI = Gingival Index, PI = Plaque Index, BOP = Bleeding on Probing
PD = Pocket depth in millimeter, CAL = Clinical attachment level in millimeter.

Table 3 shows the comparison of GCF and serum levels in 25-Hydroxy vitamin D3. The mean value and standard deviation of 25(OH) vitamin D3 in the study group, GCF at baseline was 3.41 ± 2.25 ng/ml, and after therapy (SRP) was 4.57 ± 2.33 ng/ml. As a result, there was a statistically significant increase in the mean post-operatively at a *p*-value of 0.022. Moreover, in the control group, it showed statistically significantly higher. The mean value and standard deviation of SRP in serum at baseline were 39.88 ± 13.64 and after therapy (SRP), was 41.48 ± 13.58 with *P*-value 0.001.

Table 3: shows the comparison of GCF and serum levels in 25-Hydroxy vitamin D3.

25(OH) VitD3	Study group	Control group	*P* –value
GCF	3.41±2.25	4.57±2.33	0.022
Serum	39.88±13.64	41.48±13.58	0.001

GCF=Gingival Crevicular Fluid.

DISCUSSION

Chronic periodontitis is a chronic condition where bacterial biofilms lead to host responses within periodontal tissues. Previous reports revealed evidence that periodontal disease is linked to low serum 25-hydroxy vitamin D3 concentrations in addition to recognized risk factors like diabetes and smoking. Thus, the present clinical study was designed to assess the levels of 25-Hydroxy vitamin D3 in GCF and serum before and after scaling and root planning (SRP) in chronic periodontitis patients.

The results of our study showed improvement of all clinical periodontal parameters (GI, PI, BOP, PD, and CAL) after SRP in chronic periodontitis patients (study group) and exhibited significant improvements of all values after therapy compared to baseline records. These findings are in agreement with several studies and many consensus reports as SRP is considered the basic therapeutic modality of chronic periodontitis. In the present study, there was a statistically significant increase in the mean GCF 25-Hydroxy vitamin D3 after performing SRP in the study group.

However, there was no statistically significant variation in mean values of serum 25-OH vitamin D3 level after SRP of the same group. These findings come in agreement with other investigators. However, they evaluated 25-OH vitamin D3 in aggressive periodontitis individuals.Previous studies found that low vitamin D levels in GCF have been associated with increased tooth loss, clinical attachment loss, and maternal periodontal disease during pregnancy. These findings are consistent with our results.

Investigators found evidence for the association of periodontal disease with low serum 25(OH) D concentrations. This result comes in disagreement with our findings that showed no difference in serum 25(OH) D3 concentrations between periodontitis patients at baseline and after therapy and also compared to the chronic gingivitis group. The patients selected for participation in the previous study were suffering from aggressive periodontitis. We can only speculate why the association between serum 25(OH) D3 concentrations and clinical attachment loss (CAL) was limited to the older subjects of both sexes. One reason may be the higher prevalence and extent of AL in older subjects than in younger subjects. In this way, older subjects may be more susceptible to the potential benefit of vitamin D3.

In another study, it was found that there was a significant inverse association between serum 25(OH) D3 concentrations and periodontal disease in both men and women aged ≥50 years. This association was independent of race or ethnicity, socioeconomic status, estrogen use among the women, smoking, and gingival bleeding.

It was concluded from the current study that 25-hydroxy vitamin D3 might have an important role in the pathogenesis of periodontal disease and could be used as an adjunctive therapeutic modality for the prevention and treatment of different types of periodontitis. Future intervention therapeutic studies with vitamin D supplementation are also recommended in both chronic peri-

odontitis and aggressive periodontitis patients to completely evaluate the role that vitamin D might play in the treatment of periodontal disease.

CONCLUSION

Scaling and root planning (SRP) is the mainstay of treatment for periodontal diseases and was effective in improving clinical parameters in patients with chronic periodontitis. 25-hydroxy vitamin D3 might have an important role in the pathogenesis of periodontal disease and could be used as an adjunctive therapeutic modality for the prevention and treatment of different types of periodontitis.

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