

## Original Article

# The effect of Vitamin E supplementation on treatment of chronic periodontitis

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## ABSTRACT

**Background:** The purpose of this study was to evaluate the effect of Vitamin E supplements on chronic periodontitis based on the clinical parameters of pocket depth and clinical attachment level and total antioxidant capacity (TAC) of saliva.

**Materials and Methods:** In this clinical trial, 16 patients with chronic periodontitis were selected and divided into two groups. The indices of pocket depth and attachment loss for 6 teeth per person were measured with a periodontal probe. A total of 41 teeth in the control group and 42 teeth in the case group were examined. Then, 2 ml nonstimulated saliva was collected from each patient. All patients were treated with scaling and root planing (SRP). The case group consumed 200 IU supplementary Vitamin E daily for up to 2 months. After 2 months, clinical indices were re-measured and 2 ml nonstimulated saliva was collected. The TAC of saliva samples was measured by using Zellbio's TAC Kit. Data were analyzed by the SPSS software and were evaluated in each group between the first session and 2 months later with paired *t*-test. The differences between the two groups were evaluated through the independent *t*-test ( $\alpha \leq 0.05$ ).

**Results:** Independent *t*-test showed that mean change in TAC ( $P = 0.14$ ) and pocket depth changes ( $P = 0.33$ ) was not significant between two groups 2 months after SRP, but mean attachment loss changes in the case group was significantly less than the control group ( $P = 0.03$ ).

**Conclusion:** The results of this study indicate that Vitamin E supplementation with SRP can reduce the inflammatory process of periodontitis and improve periodontal clinical indices and decrease the amount of attachment loss.

**Key Words:** Anti-inflammatory, antioxidant, periodontal disease, Vitamin E

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## INTRODUCTION

Chronic periodontitis is caused due to the accumulation of plaque and calculus. It is a chronic inflammatory disease that affects the supporting tissues of the tooth, leading to progressive loss of

periodontal ligaments and alveolar bone. It increases periodontal pocket depth, gingival recession, or both. Chronic periodontitis, the most common form of periodontitis, is more common in people

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over 30 years of age and has a slow-to-moderate progression.<sup>[1]</sup> Free oxygen-producing reactions are the heart of periodontal tissue degradation. The interaction of host and germs leads to increase the production of reactive oxygen species (ROS) and the reduction of antioxidant activity and the activation of proinflammatory cytokines.<sup>[2]</sup>

A dental plaque-containing periodontal pathogen bacteria stimulates host cells and produces cytokines. These cytokines absorb polymorphonuclear (PMN) into the area of infection. PMNs fight pathogens by producing proteolytic enzymes and ROS.<sup>[3]</sup> Increasing ROS molecules is directly related to periodontitis.<sup>[4-7]</sup> The human body has an antioxidant defense system whose function is to neutralize ROS and change it to less active forms. This system contains Vitamins A, B, C, D, and E and carotene and oxidizing enzymes including superoxide dismutase (SOD), catalase, and myeloperoxidase.<sup>[3]</sup> Vitamin E is the body's main fat-soluble antioxidant.<sup>[8]</sup> With histochemical study defined that, the concentration of Vitamin E as antioxidant in the soft tissue of patients with periodontitis decreased.<sup>[9]</sup> Protective role of Vitamin E on the preservation of alveolar bone, which has a supporting role in periodontitis have been reported.<sup>[10]</sup> On the other hand, some studies found that Vitamin E had no effect on the treatment of periodontitis.<sup>[11]</sup> An experiment on rats states that Vitamin E treatment reduced the inflammatory process of periodontitis but does not affect the loss of alveolar bone.<sup>[12]</sup> Study on the effect of food containing antioxidants, including Vitamin E, on the improvement of periodontitis, demonstrated a marked decrease in pocket depth as an indicator of the disease's progression.<sup>[13]</sup> On the other hand, in an epidemiologic study, a nonlinear inverse relationship between alpha-tocopherol as one types of Vitamin E in the body and pocket depth and attachment loss has been shown.<sup>[14]</sup> According to a clinical trial, SOD as an antioxidant index in both pre- and post-SRP patients increased in both case (taking Vitamin E) and control groups, but the increase was higher in the case group.<sup>[15]</sup> Total antioxidant capacity (TAC) is an indicator for measuring the cumulative performance of all antioxidants in the body.<sup>[16]</sup> This indicator significantly decreases in the serum of people with periodontitis compared to healthy people.<sup>[2,17,18]</sup> Furthermore, in patients with periodontitis before and after SRP treatment, there is a significant increased after the treatment.<sup>[19,20]</sup> It was speculated micronutrient including vitamins can

modulate host response. The aim of this study was to evaluate the efficacy of Vitamin E supplement on periodontal parameters following scaling and root planing (SRP) in chronic periodontitis patients which used this supplement compared to the control group.

## MATERIALS AND METHODS

This study (IRCT20110109005570N10) was designed as a blind, randomized clinical trial to evaluate the efficacy of Vitamin E on periodontal parameter in chronic periodontitis patients after 2 months of administration. Sixteen patients with chronic periodontitis were selected from the patients referred to dental school of the Isfahan University of Medical Sciences. The inclusion criteria included generalized chronic mild and moderate periodontitis. The amount of clinical attachment loss (CAL) between 1 and 5 mm, ages 25 and more. The exclusion criteria included: liver disease or specific drug use, antibiotic used during the past 3 months, pregnancy, obesity (body mass index >25), smoking or alcohol, blood diseases, unwillingness to continue the study. In this study, two patients (one person from each group) were excluded due to the lack of referral after 2 months. The patients were randomly divided into two groups. At the first, the pocket depth and CAL for 6 teeth with periodontal probe was measured. A total of 42 teeth in the case group and 41 teeth in the control group were evaluated. Then, 2 ml of nonirritated saliva was taken by the spitting method.<sup>[19]</sup> In such a way that the patient does not eat anything 1 h before collecting and he throws his mouth water, he drains his mouth into the test tube. Based on the statistical data, these two groups did not have a significant difference in age ( $P = 0.08$ ) and plaque index (PI) ( $P \leq 0/01$ ). Full mouth SRP and oral hygiene instruction was down for all patients. A baseline visit was performed after 2 weeks for controlling oral hygiene and any residual calculus. The case group received 200 IU supplementary Vitamin E (E-Vigel 200, Dana Pharma Co, Iran) to consume daily up to 2 months. Once a week, patients were called to remind them. Both groups were recalculated 60 days after the first referral. Clinical indices were re-measured and 2 ml nonstimulated saliva was collected. The saliva was collected in a 15-ml Falcone tube. The TAC of saliva was measured by the Zellbio® TAC Kit (Germany). The saliva was centrifuged for 5–10 min at a speed of 3000 rpm, subsequently; the flotation material formed on the tube after the centrifuge was evaluated with

Kit-ELISA. The obtained number in mili molar (mM) indicates the antioxidant capacity of the saliva. Data were analyzed using the SPSS version 20 software (version 20, IBM Corp., Armonk, N.Y., USA). Data were analyzed in each group between the first session and 2 months after with paired *t*-test. The difference in variations between the two groups was evaluated through the independent *t*-test. The significance level of the data was calculated with  $P < 0.05$ .

## RESULTS

The mean age in the case group was 44.4 years and in the control group 40.7 years, which did not differ significantly ( $P = 0.08$ ). The mean of TAC in the case group before intervention was 0.05 mM, and in the control group, it was 0.08 mM, which was not significantly different ( $P = 0.15$ ). The average of the index of pocket depth before the intervention was 3.9 mm in the case group and 4.1 mm in the control group, which did not differ significantly ( $P = 0.17$ ). The mean of CAL before the intervention was 1.6 mm in the case group and 1.2 mm in the control group, which had no significant difference ( $P = 0.13$ ) [Table 1]. The mean of TAC in the case group was 0.17 mM after 2 months and 0.22 mM in the control group, which did not differ significantly ( $P = 0.14$ ). The mean of pocket depth in the case group was 1.1 mm after 2 months and 1.2 mm in the control group, which did not differ significantly ( $P = 0.33$ ). The mean of the CAL in the case group was 0.9 mm in 2 months and 1.1 mm in the control group, which had a significant difference ( $P = 0.03$ ), [Table 2].

Paired *t*-test showed that the mean TAC index increased significantly in both groups, 2 months after SRP than before it ( $P < 0.001$ ). The mean of pocket depth in both groups was decreased significantly 2 months after SRP ( $P < 0.001$ ). The mean of CAL significantly decreased in the case group 2 months after SRP compared to before SRP ( $P < 0.001$ ), but in the control group, there was no significant difference between the two times ( $P = 0.25$ ).

## DISCUSSION

The gold standard treatment of periodontal disease is the mechanical removal of subgingival plaque and root debridement. However, some cases have a high susceptibility and they not respond well to this treatment. It has been speculated nutritional intervention can modulate host response and

Vitamins (C, E, A, and D) can downregulate pro-inflammatory cascades by acting as antioxidants to lessen oxidative stress. Vitamin E is a fat-soluble agent present in cell membranes and can inhibits oxidative damage in membrane lipids. It exhibits anti-inflammatory properties by reducing PGE2 production from the macrophages and improving the humoral immune response.<sup>[10]</sup> In this study, Vitamin E was evaluated for its effect on periodontal parameter compared to the control group in chronic periodontitis patients. We evaluated three indices: TAC, pocket depth (PD), and CAL in both case and control groups once before complete SRP and once 2 months later.

The results in the present study showed significant improvement in the clinical attachment level within 2 months in the test group compared to the control. Other parameter including PD and TAC did not show any significant differences although PI and PD in the test group showed significant reduction from the baseline value. It can be assumed that these comparable outcomes are due to the SRPs done equally for both groups as the mechanical removal of plaque has effects on the improvement of PI and PD. The results of this study were similar to those of Novakovic *et al.* study.<sup>[19,20]</sup> Singh *et al.* study,<sup>[15]</sup>

**Table 1: Mean of total antioxidant capacity, pocket depth, and attachment loss in two group before scaling and root planing**

Variable	Mean±SD		P
	Case group	Control group	
TAC index	0.05±0.04	0.08±0.05	0.15
PD index	3.9±0.8	4.1±0.7	0.17
CAL index	1.6±1.2	1.2±0.8	0.13

SD: Standard deviation; TAC: Total antioxidant capacity; PD: Pocket depth; CAL: Clinical attachment loss

**Table 2: Mean of total antioxidant capacity, pocket depth and attachment loss, and their changes in two group before and 2 months after scaling and root planing**

Variable	Group	Mean±SD		P <sup>a</sup>	Mean±SD	P <sup>b</sup>
		Before SRP	2 months later			
TAC	Case	0.05±0.04	0.17±0.11	<0.001	0.12±0.07	0.52
	Control	0.08±0.05	0.22±0.18	<0.001	0.14±0.1	
PD	Case	3.9±0.8	3.1±0.3	<0.001	-0.8±0.5	0.32
	Control	4.1±0.7	3.2±0.4	<0.001	-0.9±0.6	
CAL	Case	1.6±1.2	0.9±0.5	<0.001	-0.7±0.5	<0.001
	Control	1.2±0.8	1.4±1.1	0.25	0.2±0.1	

<sup>a</sup>Paired sample *t*-test; <sup>b</sup>Independent samples *t*-test. SD: Standard deviation; TAC: Total antioxidant capacity; PD: Pocket depth; CAL: Clinical attachment loss

Cohen *et al.* study,<sup>[21]</sup> but were different with the results of Zong *et al.* study,<sup>[14]</sup> Carvalho *et al.* study.<sup>[12]</sup>

Previous studies demonstrated inverse associations between the prevalence of the periodontitis and Vitamin E and total antioxidant level, even though the findings were inconsistent and must undergo further evaluations.<sup>[14]</sup>

TAC is an indicator that measures the total antioxidant capacity of saliva. This indicator showed significant difference over time in both case and control groups. However, the difference was not significant between the two case and control groups during the time. Removal of microbial plaque and oral health education can change the oxidative and anaerobic environment of the mouth toward the aerobic and antioxidant environment, which justifies the positive and incremental changes in the antioxidant properties of saliva over time.

In a randomized clinical trial, Novakovic *et al.*<sup>[20]</sup> reviewed the TAC and albumin (alb) and ureic acid (UA) of saliva. Half of the patients were treated with SRP, and the other half just received health education. After 2 months in participants with SRP, TAC, and alb and UA, respectively, increased. The results of this study were similar to the present study, and SRP increased the antioxidant capacity of saliva.

The effect of Vitamin E on SOD enzyme was investigated. SOD was evaluated as an antioxidant index in serum and saliva in 22 individuals without periodontitis and in 38 participants with periodontitis. The enzyme was measured 1 times before SRP and once every 3 months after SRP. The case group was divided into two groups. One group received one tablet of Vitamin E 300 IU for 3 months. After 3 months, the level of enzyme was increased in both groups, but in the group receiving Vitamin E, it was significantly higher than the other group.<sup>[15]</sup> Part of the results of mentioned study confirms our results (increasing the antioxidant capacity of saliva after scaling), and the other part, which has a significant difference between the two groups of vitamin and nonconsuming users, is different from the present study. Of course, in the later study, the SOD index has been used as an indicator of antioxidant capacity, which can justify a difference in results.

Progressive degeneration of attachment apparatus over time is the main indicator of the diagnosis of periodontitis from gingivitis. CAL significantly

decreased in the case group after 2 months (from 1.6 mm to 0.9 mm,  $P < 0.001$ ), but the CAL in the control group did not differ significantly. The change in the index between the two groups was significant ( $P < 0.001$ ). According to the results, it seems that taking Vitamin E may have an impact on improving attachment gain. Scaling alone has no effect on the improvement of attachment gain and benefits for the reduction of superficial gingival inflammation.

In a randomized clinical trial, conducted by Houshmand *et al.*,<sup>[22]</sup> after scaling and root planning, Vitamin E 5% was placed in one side and the placebo in the other side of a customized tray, and PD, CAL, BOP, gingival index (GI) were measured. The effect of the type of treatment on evaluated indices was not significant, while the effect of time was significant on most indices. It is difficult to compare this study, and direct comparisons of the clinical effects were not allowed due to the different study designs, methods of administration, and different compositions in the mixture.

A cross-sectional epidemiologic study was conducted on the American population to determine the relationship between  $\alpha$ -tocopherol and  $\gamma$ -tocopherol in serum, and periodontitis, on people who participated in NHANS study. The  $\alpha$ -tocopherol was measured by high-performance liquid chromatographic, and the values were compared with total serum cholesterol. Periodontal status was measured by CAL and PD indices. An inverse nonlinear relationship was observed between the severity of periodontal disease and serum  $\alpha$ -tocopherol.<sup>[14]</sup> With regard to CAL index, there are controversial results, compared to the present study, which may be related to the type of study. In this cross-sectional study, merely, the current situation of the patients was considered, while in the present study, in contrast to Zong's study, Vitamin E treatment dosage, which exceeds the amount of in-taken dosage of Vitamin E through the oral consumption of nutrients, was considered to modify the antioxidant condition, and on the other hand, the changes in persons indices, compared to their own profile, was considered as the criterion for the comparison and not those of the whole studied population.

The third indicator was pocket depth. PD after 2 months in both case and control groups significantly decreased. The changes in PD between two groups

were not significant ( $P < 0.33$ ). Scaling and oral hygiene education had a positive impact on the reduction of pocket depth. Periodontal pocket can be due to increased gingival inflammatory volume or loss of attachment of periodontal fibers, or both. It seems by doing scaling the amount of inflammatory reaction is reduced.

Cohen *et al.*<sup>[21]</sup> compared the local effects of Vitamin E 5% and chlorhexidine 12% on PI, GI and the depth of periodontal pockets. The data indicated no significant difference in indices after the use of local gel of Vitamin E and the placebo group, whereas the use of chlorhexidine 12% had a significant effect on the improvement of indices. The depths of pockets were consistent in Cohen's study and the present study, and in both studies, consumption of Vitamin E supplements had no effect on PD improvement. As the same Houshmand *et al.*<sup>[22]</sup> reported no effect of Vitamin E on PD improvement.

In the study of Zong *et al.*<sup>[14]</sup> an inverse nonlinear relationship was observed between the depth of the pocket and the level of serum Vitamin E, which is in line with the present study, although the difference in the methods of previous studies should not be ignored as a confounding factor in the evaluation and comparison of the results.

The results of a study which used the combinations of Vitamin C, Vitamin E, lysozyme, and carbazochrome (CELC) in the treatment of chronic periodontitis following SRP showed significant improvement in the mean change of GI, but other periodontal parameters, including PI, PD, and CAL did not show any significant differences.<sup>[23]</sup> The different result in some parameters as CAL may be related to sample size, kind of vitamin consumption, and methods of evaluation. However, the effect of vitamins should be carefully analyzed and the possible beneficial effects on periodontal disease should be considered.

## CONCLUSION

Within the limitations of the present study, Vitamin E adjunctively administered SRP exhibited a significant reduction in the index of attachment loss in a short-term investigation. SRP alone decreased pocket depth and increases the antioxidant capacity of the saliva and taking Vitamin E supplementation can increase this positive effect of SRP and also increased the clinical attachment level of periodontal tissue and improvement of periodontal disease.

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## Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or nonfinancial in this article.

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