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Role of Vitamin C in Patients with Chronic Periodontitis and ItsInfluence on Salivary Total Antioxidant Capacity Levels.

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Abstract

Objective: To assess the role of vitamin C in patients with chronic periodontitis and its influence on salivary total antioxidant capacity levels.

Materials and Methods: The study comprised 0f 30 subjects with chronic periodontitis and 30 healthy controls. Thirty chronic periodontitis patients were further categorized into two groups (CGP1 and CGP2). Fifteen patients in CGP1 were treated with nonsurgical therapy and 15 patients in CGP2 were administered with 1500 mg of Vitamin C supplementation per day along with nonsurgical therapy. Patients were evaluated for plaque index, gingival index, gingival bleeding index, pocket depth, and clinical attachment level at 30 days and 60 days post treatment. The salivary total antioxidant capacity levels were analyzed by Koracevic's method at initial visit and 60 days post treatment.

Results: Subjects with chronic periodontitis showed decreased salivary total antioxidant

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capacity levels in comparison with healthy controls. A significant reduction in all the clinical parameters and salivary total antioxidant capacity levels in both groups of chronic periodontitis at 30 days and 60 days post treatment was observed. Patients in CGP2 showed a significant reduction in gingival bleeding index score but no significant improvement in plaque index, gingival index, pocket depth, and clinical attachment level and in salivary total antioxidant capacity levels was noted when compared with subjects of CGP1.

Conclusion: Vitamin C supplementation revealed a significant reduction in gingival bleeding index score at 30 days and 60 days post treatment but no significant improvement with respect to other periodontal parameters and salivary total antioxidant capacity levels was noted as compared to nonsurgical therapy.

Keywords: Vitamin C. chronic periodontitis, treatment

Introduction

Ninety percentage of the world population is known to be affected from periodontal diseases.[1] Destruction of the alveolar bone supporting the teeth followed by mobility and loss of teeth is noted in the course of periodontitis. It has been observed that periodontitis may also enhances the risk of other conditions like type 2 and diabetes mellitus, cardiovascular pathologies, and may also lead to undesired pregnancy outcomes.[2]

Vitamin C is a significant water-soluble vitamin which is found in many fruits and vegetables used in routine diet. It has proven beneficial actions on the human body system and is popularly used as a nutritional supplement, alone or in combination with other micro and macro nutrients.[3]

The antioxidant properties of vitamin C is beneficial in minimizing the oxidative stress, elimination of free radicals, and reactive oxygen species, thereby aiding in the favorable outcomes of periodontal treatment.[4]It has been stated previously that the influence of vitamin C along with chlorhexidine is known to prevent and slow down the progression of periodontal diseases. Even though it has been suggested that vitamin C consumption is mandatory to maintain the health of the periodontal tissues, supplementation with vitamin C is not considered as an only treatment option in treating the diseases affecting the periodontal tissues.[4]

It has been observed in the literature that the appropriate administration of vitamin C helps in lowering the level of inflammatory response because of its antioxidant properties. Previously, numerous clinical researches in humans and animal models have been carried out to understand the preventive and therapeutic role of vitamin C with regards to diseases affecting the periodontium. In spite of this, there is lack of evidence that support the administration vitamin C as a monotherapy in managing periodontal pathologies.[5]

It has been also proposed that vitamin C along with non-surgical periodontal treatment modality may help to get desirable treatment responses.[5] With this background, the present study was carried out to assess the role of vitamin C in patients with chronic periodontitis and its influence on salivary total antioxidant capacity levels.

Materials and methods

A total of 60 individuals (30 diagnosed as with chronic periodontitis and 30 healthy individuals)

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were incorporated in this study. Clearance was obtained from ethical committee of the institute and consent was obtained from all the participants.

The study participants were in the aged 30 years and above who were otherwisehealthy, and were having a minimum of 20 scorable teeth present.

The following exclusion criteria was considered

- Patients using nonsteroidal anti-inflammatory drugs or antimicrobial drugs, mouthwashes, or vitamin or antioxidants within90 days before onset of the study
- Patients on special dietary requirements,
- Patients with history of using any drugs affecting salivary secretion during last 90 days
- Patients with history of any known in tolerance/allergy to vitamin C
- Patients withhistoryofperiodontaltherapyintheprevious6months,
- Pregnant and lactating females

Thirty subjects in study group were diagnosed with chronic periodontitis and 30 patients in the control group were selected according to the criteria of previous similar study.[6]

After recruitment, a total of 60 participants (30 with chronic periodontitis and 30 with clinically healthy periodontium) who fulfill the selection criteria were subjected to unstimulated whole salivary sample collection for biochemical estimation of salivary total antioxidant capacity levels by Koracevic's method.[7]

A standard approved toothpaste (200g) which was free of anti-inflammatory, antioxidant agent was prescribed to all the participants for brushing their teeth and the participants were advised to follow the modified bass tooth brushing technique. During the same appointment, chronic periodontitis patients were randomly categorized into Group I (CPG1) and Group II (CPG 2) and subjected to assess clinical indices such as plaque index,[8] gingival index,[9] and gingival bleeding index.[10] clinical attachment level and pocket depth [11] were documented.

Patients in CPG1 were treated only with conventional nonsurgical therapy which included scaling and root planning whereas patients in CPG2 underwent similar nonsurgical therapy along with daily supplementation of Limcee500 mg chewable Tablet [vitamin C (Ascorbic acid) ABBOTT HEALTHCARE PVT LTD] as a part of routine periodontal therapy, three times a day for a period of 60days. Clinical parameters were reevaluated after 30- and 60-days post treatment. After 60 days, the unstimulated whole saliva of the participants of CPG1 and CPG2 were collected using standard method[12]andsubjectedforestimationofsalivarytotal antioxidant capacity by Koracevic's method.

Statistical Analysis

The obtained data was analyzed using Statistical Package for the Social Sciences (SPSS) for Windows (version 21.0; SPSS, Chicago, IL, USA). The descriptive statistics mean, standard deviation, were calculated and ANOVA, Tukey HSD post hoc test and Student's t-test were applied. A p value of < 0.05 was considered statistically significant.

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Results

The mean plaque index, gingival index, gingival bleeding index, pocket depth, and clinical attachment level in patients with chronic periodontitis of both treatment groups (CPG1 and CPG2) at baseline, 30- and 60-days post treatment are represented in Table 1. On comparison, there was no statistically significant difference in clinical parameters of subjects of CPG1 and CPG2 except plaque index and gingival bleeding index, which revealed statistically significant improvement in patients of CPG2 group, compared to those of CPG1 group at 30- and 60-days post treatment (Table 1).

At baseline, 30- and 60-days post treatment, no significant difference in plaque scores between subjects of CPG1 and CPG2 was observed. A significant difference in mean scores of gingival bleeding index between patients of CPG1 and CPG2 at 30- and 60-days post treatment was noted. Sixty days' post treatment gingival bleeding index for patients in CPG1 was 25.17±2.32 as compared to score of 19.78±1.45 in patients of CPG2. The gingival bleeding index was significantly reduced in patients with CPG2 group as compared to patients of CPG1 group.

There was no significant difference with respect to mean scores of gingival index, pocket depth, and clinical attachment level between patients of CPG1 and CPG2 at baseline, 30- and 60-days post treatment. There was significant improvement in plaque index, gingival index, gingival bleeding index, pocket depth, and clinical attachment level scores at 30- and 60-days post treatment in CPG1 and CPG2 as compared to baseline scores ($P < 0.001$).

The mean salivary total antioxidant capacity levels for all study groups at baseline and 60-days post treatment are shown in in Table 2. A statistically significant difference was noted among patients of CPG1 (541.91±32.41) and subjects of control group (781.32±41.13) as well as patients in CPG2 (514.16±12.98) and control group (781.32±41.13) ($P < 0.001$), but there was no significant difference in mean salivary antioxidant levels between patients of CPG1 and CPG2 ($P = 0.061$). At 60 days' post treatment comparison of mean salivary antioxidant levels between CPG1 and CPG2 patients was statistically non-significant ($P = 0.276$).

The mean salivary total antioxidant capacity levels increased from baseline to 60-days post therapy in both CP1 and CP2 patients and the difference was statistically significant ($P < 0.001$).

Discussion

Periodontitis is an inflammatory condition that is caused by various microorganisms, which later progresses via an altered host immune response, and there by leading to loss of the tooth supporting structures. Polymorphonuclear leukocytes are significantly responsible for the defensive action against periodontal pathogens.[13]They produce an antimicrobial action at the location of pathology by initiating intracellular signaling pathways, which also includes reactive oxygen species. Reactive oxygen species possess cytotoxic effect on periodontal tissues at increased concentrations.[14] Oxidative stress by polymorphonuclear leukocytes is considered as the main reason for the destruction of periodontium in the course of periodontal disease process. Patients with periodontal disease exhibits increased levels of biomarkers that suggests tissue damage secondary to reactive oxygen species.[15]

It has been proved in the literature that vitamin C plays a significant role in vascular function.

It modulates vasorelaxation by increasing nitric oxide production in many ways. Endothelial oxide synthase produces nitric oxide production, which diffuses to the smooth muscle cell layer of the vascular wall and mediates dilation through its interaction with soluble guanylyl cyclase.[3] Tetrahydrobiopterin is a cofactor for endothelial oxide synthase activity, and vitamin C is thought to recycle tetrahydrobiopterin from its oxidized form, thereby sustaining the enzyme's action.

Moreover, vitamin C may affect nitric oxide bioavailability through ascorbate-mediated denitrosylation and phosphorylation of endothelial oxide synthase. Vitamin C also influence the vascular function by modulating the endothelial cell barrier and regulating the activity of NADPH oxidases which is involved in inflammatory gene response.[16]

Vitamin C possess powerful antioxidant action with a capacity to minimize many pathophysiologically relevant free radicals and reactive oxygen species. Vitamin C is also known to play a significant role in preventing and slowing the progression of many pathological conditions.[5]

Vitamin C regenerates vitamin E from its oxidized state, which allows vitamin C to indirectly stop the peroxidation of the lipids.3 Vitamin C, can also minimize urate and glutathione radicals as part of the antioxidant network in cells and extracellular fluids. Even though it is difficult to assess the clinical, significance of antioxidant action of vitamin C, previous data has revealed that vitamin C effectively prevents biologic macromolecules from oxidative damage that might otherwise causally contribute to the initiation and progression of several chronic and acute diseases.[17]

It has been observed that periodontal pathologies were significantly related with the vitamin C levels of the affected individuals. The patients with periodontitis demonstrated increased levels of vitamin C in blood as compared to healthy individuals. The explanation behind this fact was transferring of the dietary vitamin C to the periodontal tissue through blood stream, thereby reducing the risk of diseases affecting the periodontium.[4]

Kaur et al.,[18] and Muniz et al.,[19] mentioned the beneficial effects of vitamin C as a dietary antioxidant in management of periodontal disease in the context of the established association between the periodontal disease and oxidative stress. They implied that, as a complementary treatment for periodontal disease, the use of an antioxidant has the capacity to enhance periodontal clinical parameters.

In accordance with observations of the present study previous studies showed improvements in gingival indices and sulcular bleeding index after treating with vitamin C alone or with non-surgical therapy.[20.21]

Similarly, Gokhale et al., did not observe any improvement in the pocket depth after administering vitamin C in periodontitis patients,[21] similarly Leggott et al., reported that vitamin C was not efficient in improving the pocket depth and attachment level.[22]

Staudte et al., observed significant decrease of the sulcus bleeding index without any improvement in plaque index and pocket depth after administration of grapefruit for 14 days.[23]

In contrast to our findings, Abou Sulaiman and Shehadeh,[24] and Vogel et al.,[25] did not observe significant change in clinical parameters including gingival bleeding index after administration of Vitamin C along with scaling and root planing.

In the present study, a significant reduction in salivary total antioxidant capacity in patients with chronic periodontitis was observed when compared to healthy individuals. Sixty days

later, chronic periodontitis patients in both treatment groups reveled increased total antioxidant capacity levels in saliva from baseline level, but intergroup comparison did not reveal any statistically significant difference among chronic periodontitis patients of both groups. This finding was in line with the results of the study by Raghavendra et al.,[6] Abou Sulaiman and Shehadeh.,[24] and Brock et al.[26]

Conclusion

Vitamin C supplementation showed significant reduction in gingival bleeding index score at 30-days and 60-days after treatment but did not to reveal any significant in reduction of plaque index, gingival index, pocket depth, clinical attachment level, and in salivary total antioxidant capacity levels as compared to nonsurgical therapy. More long-term, well-designed, longitudinal studies with better assessment criteria are needed to produce conclusive evidence that administration of vitamin C in conjunction with initial periodontal therapy for treating chronic periodontitis.

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Tables

Table 1: Intergroup comparison of mean scores of plaque index, gingival index, gingival bleeding index, pocket depth, clinical attachment level between CGP1 and CGP2 after 30 and 60 days of treatment

Parameter	Group	Baseline	30 days after treatment		60 days after treatment	
		Mean ± SD	Mean ± SD	*P*	Mean ± SD	*P*
PI	CGP 1	2.41±0.62	0.61±0.21	0.570	0.74±0.31	0.226
	CGP 2	2.39±0.26	0.59±0.26		0.76±0.26	
GI	CGP 1	2.32±0.14	1.19±0.32	0.213	1.27±0.31	0.418
	CGP 2	2.29±0.27	1.33±0.27		1.32±0.23	
GBI(%)	CGP 1	69.45±4.17	23.23±1.25	0.001*	25.17±2.32	0.001*
	CGP 2	64.56±1.56	19.25±1.99		19.78±1.45	
PD(mm)	CGP 1	3.56±0.51	2.61±1.71	0.287	2.31±0.81	0.66
	CGP 2	3.59±0.34	2.82±2.55		2.55±0.43	
CAL(mm)	CGP 1	5.25±0.87	4.11±0.55	0.673	3.41±0.43	0.728
	CGP 2	5.28±0.24	4.19±0.12		3..63±0.22	

* Significant

Table 2: Mean salivary total antioxidant capacity levels between CGP1, CGP2 and control group

Salivary TAOC	Control	CP1	P	Control	CP2	P
Baseline	781.32±41.13	541.91±32.41	0.001*	781.32±41.13	514.16±12.98	0.001*
60 days		661.71±39.62			639.74±62.15	0.276

* Significant