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ORIGINAL ARTICLE

A clinical and microbiological study to evaluate the effect of dietary supplement of coenzyme Q10 in nonsurgical treatment outcome of chronic periodontitis patients after phase 1 periodontal therapy

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ABSTRACT

Aim: The present study was aimed to evaluate the effect of dietary supplement of coenzyme Q10 (CoQ10) in nonsurgical treatment outcome of chronic periodontitis patients after phase 1 periodontal therapy. **Materials and Methods:** A total of 50 generalized chronic periodontitis patient between the aged ranges between 18 and 55 years were enrolled in the study and divided into two categories (A and B). Clinical and microbiological parameters were recorded prior to phase 1 therapy; and subjects were put on conventional oral hygiene regime. The subjects under group B were incorporated with CoQ10 as nutritional dietary supplement (TDS). **Results:** The results of this study showed that there was significant decrease in clinical and microbiological parameters from baseline to 4 months in both groups ($P < 0.01$). The subjects under group B incorporated with dietary supplement of CoQ10 showed a highly significant reduction to all the parameters when compared to subjects under group A. **Conclusion:** Long-term regular intake of nutritional dietary supplement of CoQ10 is more beneficial in nonsurgical treatment outcome of periodontal disease.

Key words
Coenzyme Q10, periodontitis, ubiquinone

INTRODUCTION

Periodontitis is a destructive inflammatory disease of the supporting tissues of the teeth and is caused by specific microorganisms or a group of specific microorganisms resulting in progressive destruction of periodontal ligament and alveolar bone with periodontal pocket formation, gingival recession or both.[1] Periodontitis is initiated by oral biofilm formation if untreated progress to gingivitis further leading to periodontal disease. The link between periodontal disease and systemic diseases has been scientifically proven over last two decades. The principle reason for this oral-systemic connection is dissemination of locally produced pro-inflammatory mediators such as C-reactive protein, interleukins-1 beta (IL-1β) and IL-6 and tumor necrosis factor alpha.[2] Similarly, systemic health, diet and nutrition also impact on oral health, in particular gingival and periodontal diseases. A person's diet can exert a topical or a systemic effect on the body and its tissues. Coenzyme Q10 (CoQ10 or ubiquinone) is a naturally occurring quinine and is one of the most significant lipid antioxidants, which prevents the generation of free radicals and modifications of proteins, lipids, and DNA. Antioxidants, such as CoQ10, can neutralize free radicals and may reduce or even help prevent some of the damage they cause. CoQ10 improves energy, augments the immune system, and acts as an antioxidant.[3] In many disease conditions connected with increased generation and the action of reactive oxygen species (ROS), the concentration of CoQ10 in the human body decreases[4-6] and the deficiency of CoQ10 leads to the dysfunction of the respiratory chain, which is due to the insufficient production of highly energetic compounds, which decrease the efficiency of cells. Periodontal disease is associated with an increased production of ROS which, if not buffered sufficiently, cause damage to the host cells and tissues.[7]

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Hence, an attempt has been made in the present study to assess and compare the effects of dietary supplement of CoQ10 in nonsurgical treatment outcome of chronic periodontitis patients after phase 1 periodontal therapy.

MATERIALS AND METHODS

The present study was conducted in the Department of Periodontology, Pravara Institute of Medical Sciences, Loni, Maharashtra, India. The research protocol was approved by the University Research and Ethical Committee. Verbal and written informed consent was obtained from all subjects prior to their voluntarily enrollment in the study.

Study population

The subjects enrolled in this study were selected from the Outpatient Department of Periodontology, Rural Dental College and Hospital, Loni, Ahmednagar, Maharashtra, India. The study included a total of 50 subjects with chronic periodontitis as illustrated in Table 1. All the 50 subjects were grouped into two categories and each group was comprised of 25 subjects each as illustrated in Table 2. Exclusion criteria for the patient enrolled in the study were: (1) Presence of any systemic neurological disorder (e.g. epilepsy or schizophrenia), (2) presence of a disease with possible effects on the immune system (e.g. chronic infections or cancer), (3) patient who have received antibiotics or nonsteroidal anti-inflammatory drug (like ibuprofen) in past 9-11 weeks, (4) patients who have received periodontal treatment in past 6 months, (5) pregnant and lactating mother, (6) patient with artificial prosthesis, (7) patients who smokes or consumes tobacco in any form, (8) patients suffering with arthritis, (9) patient with any type of heart disease (myocardial infarction, coronary heart disease, etc.), (10) female patient using intrauterine birth control devices or birth control pills, (11) obese individuals (30 and above range as per WHO body mass index cut-off for weight categories for Asians), (12) presence of diabetes mellitus (13) participants not willing to participate in the study.

Table 1: Age and sex wise distribution of the cases in both groups (A and B)

Age in years	Group A (*n*=25) (%)		Group B (*n*=25) (%)	
	Male	Female	Male	Female
<30	1 (7.14)	0	1 (6.67)	1 (10)
30-40	7 (50)	7 (63.63)	11 (73.33)	7 (70)
40-50	5 (35.71)	4 (36.37)	3 (20)	2 (20)
50-60	1 (7.14)	0	0	0
Total	14 (56)	11 (44)	15 (60)	10 (40)

Table 2: Distribution of chronic periodontitis patients in study groups (A and B)

Group	Patient clinical protocol	Number of subjects
A	Chronic periodontitis patients with complete oral prophylaxis (phase 1 therapy) followed by use of conventional toothpaste and mouth wash	25
B	Chronic periodontitis patients with complete oral prophylaxis (phase 1 therapy) followed by use of conventional toothpaste and mouth wash along with dietary supplement of CoQ10 (TDS×4 months)	25

CoQ10–Coenzyme Q10

Clinical protocol

After the enrollment of the subjects in the study, phase 1 therapy (scaling and root planning) was done by similar Electro Medical Systems ultrasonic scaler by the same operator to all the 50 subjects at first visit (baseline) only. After phase 1 therapy, subjects under both the groups were advised to brush twice a day for 5 min by modified bass method (technique demonstrated to each subject) and similar medium bristle toothbrush and toothpaste is provided to each of the subjects during the study course. After phase 1 therapy, subjects under group B were further advised to take a nutritional supplement of CoQ10 (Oxyfresh® Company) TDS for 4 months. Recall visits were scheduled for all the subjects belonging to both groups (A and B) on 2nd and 4th month and no phase 1 therapy (scaling and root planning) was done at the recall visits. All the clinical and microbiological parameters of 50 subjects enrolled in a clinical trial were recorded at the base line, 2nd and 4th month.

Clinical parameters protocol

Clinical parameters of periodontal disease that were evaluated were gingival index (GI), plaque index (PI) and clinical attachment loss (CAL).

Gingival index

The teeth selected as index teeth were 16, 12, 24, 32, 36 and 44. The tissues surrounding each tooth were divided into four gingival scoring units: Disto-facial papilla, facial gingival margin, mesio-facial papilla and the entire lingual gingival margin. A blunt instrument such as a periodontal probe was used to assess the bleeding tendency of the tissues. The index for each index tooth was recorded and then calculated by dividing total number of index teeth examined. This provided the GI for the individual.

Plaque index

All teeth were examined on four surfaces (i.e. mesiobuccal, buccal, distobuccal and lingual/palatal) after using a disclosing agent.

$$PI = \frac{\text{Total plaque score}}{\text{Number of surfaces examined}}$$

Clinical attachment loss

The clinical attachment level was examined with William's graduated probe. Clinical attachment level

represents distance from cementoenamel junction to the base of the gingival sulcus or periodontal pocket. Average CAL of the person is calculated by dividing the total clinical attachment level by the number of teeth examined. Chronic periodontitis is sub classified as mild or slight, moderate and severe periodontitis based on CAL according to American Academy of Periodontology 1999 classification of periodontal diseases. If gingival recession is present then, loss of attachment is calculated by the distance between the cement enamel and gingival margin to be added to pocket depth.

Microbiological protocol

Subgingival plaque samples were collected for specific bacterial examination that is, *Aggregatibacter actinomycetemcomitans* (Aa), *Fusobacterium nucleatum* (Fn), *Porphyromonas gingivalis* (Pg) and *Prevotella intermedia* (Pi). Subgingival plaque samples were then collected from the sample sites using the standardized paper point (Dentsply)® which were inserted to the depth of the periodontal pocket until resistance was felt. The paper points were retained for 20 s in the collection sites. The samples site selected was maxillary first molar in all the cases to maintain the standard protocol. After 20 s the paper point was removed from the sample site and immediately transferred into Robertson's cooked meat transport (RCM) in a test tube for specific bacterial culturing. In the laboratory, the RCM was subjected to vortex homogenization for 60 s before incubated anaerobically (Gas pack system) for 2-3 days.

RESULTS

Distribution of mean and standard deviation values of all the clinical and microbiological parameters of both the groups (A and B) were illustrated in Tables 3 and 4. After applying Student's Paired *t*-test, there was a highly significant decrease in clinical and microbiological parameters from baseline to months in groups A and B (i.e. $P < 0.01$). It was observed that group B showed more significant decrease as compared to the group A (i.e. $P < 0.01$) as illustrated in Tables 5 and 6. Also by applying Student's unpaired *t*-test there was a highly significant difference between mean values of all clinical and microbiological parameters in the group A versus B (i.e. $P < 0.01$). It was concluded that the mean clinical and microbiological parameters in group B showed a larger decrease than group B ($P < 0.01$) as shown in Figures 1 and 2 (A vs. B). By applying two-way ANOVA (Tukey–Kramer multiple comparison tests) test there was a significant difference between groups A and B when compared together in respect to clinical and microbiological parameters ($P < 0.05$). The percentage decrease in clinical parameters (GI, PI, CAL and probing depth) from baseline to 4th month in group B was 10.22%, 13.39%, 17.38% and 9.79% when compared to group A, that is, 3.01%, 5.41 and, 4.25% and 3.78%. The percentage decrease in microbiological parameters (Aa, Fn, Pg and Pi) from base line to 4th month in group B was 24.12%, 17.94%, 19.68% and 21.31% as compared to group A, that is, 22.62%, 16.33%, 12.03% and 18.16%. This statistical significant increase in the percentage of group B when compared to group A attributed to the effect of dietary supplement of CoQ10.

DISCUSION

A deficiency of CoQ10 at its enzyme sites in the gingival tissue may exist independently of and/or because of periodontal disease.[8] If a deficiency of CoQ10 existed in the gingival tissue for nutritional causes and independently of periodontal disease, then the advent of periodontal disease could enhance the gingival deficiency of CoQ10. In such patients, oral dental treatment and oral hygiene could correct the plaque and calculus, but not that part of the deficiency of CoQ10 due to systemic cause; therapy with CoQ10 can be included with the oral hygiene for an improved treatment of this type of periodontal disease.[9] The specific activity of succinic dehydrogenase CoQ10 reductase in gingival tissues from patients with periodontal disease against normal periodontal tissues has been evaluated using biopsies, which showed a deficiency of CoQ10 in patients with periodontal disease. On exogenous CoQ10 administration, an increase in the specific activity of this mitochondrial enzyme was

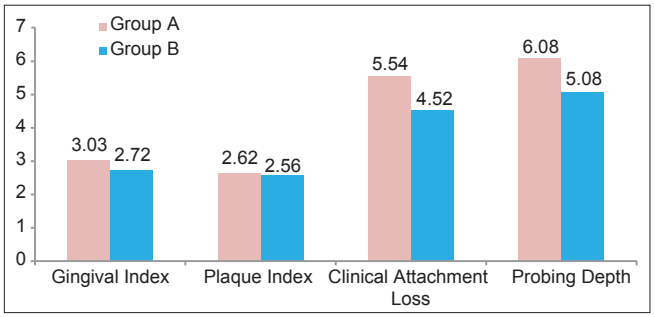

Figure 1: Comparison of mean values of clinical parameters in group A and group B at 4 months

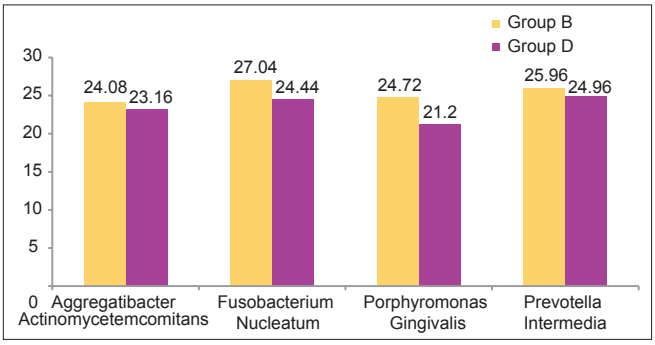

Figure 2: Comparison of mean values of microbiological parameters in group A and group B at 4 months

Table 3: Distribution of mean and SD values of clinical parameter in groups (A and B)

Groups	Clinical parameters	Baseline	2nd month	4th month
A	GI	3.19±0.27	3.05±0.27	3.03±0.27
	PI	2.77±0.27	2.63±0.27	2.62±0.27
	PD	6.74±0.79	6.28±0.72	6.08±0.65
	CAL	5.64±0.60	5.46±0.62	5.40±0.63
B	GI	2.84±0.43	2.74±0.43	2.72±0.43
	PI	2.65±0.26	2.58±0.27	2.56±0.28
	PD	5.28±1.16	5.14±1.15	5.08±1.16
	CAL	5.64±0.72	4.84±0.72	4.52±0.73

SD – Standard deviation, PD– Probing depth, CAL – Clinical attachment loss, PI – Plaque index, GI – Gingival index

Table 4: Distribution of mean and SD values of microbiological parameter in groups (A and B)

Groups	Microbiological parameters	Baseline	2nd month	4th month
A	Aa	31.12±7.49	26.84±7.23	24.08±7.32
	Fn	32.32±5.81	29.52±5.59	27.04±5.83
	Pg	30.40±6.09	27.04±5.25	24.72±4.95
	Pi	31.72±6.19	28.52±5.94	25.96±5.79
B	Aa	31.12±7.49	24.92±7.07	23.16±7.15
	Fn	28.40±6.49	26.32±6.42	26.04±5.83
	Pg	26.92±5.14	24.28±4.73	23.68±4.98
	Pi	31.72±6.19	26.52±5.94	24.96±5.79

Aa – *Aggregatibacter actinomycetemcomitans*, Fn – *Fusobacterium nucleatum*, Pg – *Porphyromonas gingivalis*, Pi – *Prevotella intermedia*, SD– Standard deviation

Table 5: Comparison of mean values of clinical parameters in group A and group B at 4 months

Clinical parameters at 4 months	Mean±SD		Unpaired *t*-test value	*P* value	Result
	Group B	Group D			
GI	3.03±0.27	2.72±0.43	5.74	<0.01	Highly significant
PI	2.62±0.27	2.56±0.28	3.01	<0.01	Highly significant
CAL	5.40±0.63	4.52±0.73	2.97	<0.01	Highly significant
PD	6.08±0.65	5.08±1.16	4.44	<0.01	Highly significant

PD – Probing depth, CAL – Clinical attachment loss, PI – Plaque index, GI – Gingival index, SD – Standard deviation

Table 6: Comparison of mean values of microbiological parameters in group A and group B at 4 months

Microbiological parameters at 4 months	Mean±SD		Unpaired *t*-test value	*P*	Result
	Group B	Group D			
Aa	24.08±7.32	23.16±7.15	0.64	>0.05	Not significant
Fn	27.04±5.83	24.44±6.32	4.01	<0.01	Highly significant
Pg	24.72±4.95	21.20±3.37	3.47	<0.01	Highly significant
Pi	25.96±5.79	24.96±5.79	0.68	>0.05	Not significant

Aa - *Aggregatibacter actinomycetemcomitans*, Fn - *Fusobacterium nucleatum*, Pg - *Porphyromonas gingivalis*, Pi - *Prevotella intermedia*, SD - Standard deviation

found in deficient patients.[9-12] This study proved that when CoQ10 (Oxyfresh® Company) dietary supplement was incorporated in the treatment regime (TDS) of periodontitis patients after phase 1 therapy statistical noticeable improvements in clinical and microbiological parameters were noted as compared to patients without dietary supplement of CoQ10 (Oxyfresh® Company) as illustrated in Figures 1 and 2. Similar to our study, previous studies had also shown that oral administration of CoQ10 increases the concentration of CoQ10 in the diseased gingiva and effectively suppresses advanced periodontal inflammation[11,13,14] and periodontal microorganisms. The possible hypothesis associated to this clinical and microbiological improvement is that CoQ10 nutritional supplement synergizes the effect and acting as potent antioxidant to counter the free ROS released during the active phase of periodontal inflammation. The other hypothesis is that healing and repair of periodontal tissues requires efficient energy production, which depends in a part on an adequate supply of CoQ10.[15] Our results were supported by previous study[16] thus concluding that CoQ10 regular dietary supplement should be considered as an adjunct with phase 1 periodontal therapy for the nonsurgical treatment of chronic periodontitis patients in current periodontal practice. However, long-term multicentric studies with more subjects will further help in understanding the potential effects of CoQ10 in treatment modality of periodontal disease.

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