Evaluation of the effectiveness of coenzyme Q10 gel in management of patients with chronic periodontitis (I intra group comparison)

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ABSTRACT

Background: Periodontal pathogens can induce free radicals over-formation and thus may cause collagen and periodontal destruction. Anti-oxidants are used as supplements to counteract the over production of free radicals in periodontal disease, that can reduce of collagen destruction. Coenzyme Q10 serves as an endogenous antioxidant, regenerates other antioxidants, stimulates cell growth, and inhibits cell death. Because it is an antioxidant, coenzyme Q_{10} has received much research attention associated with periodontal diseases. Perio Q gel may possibly be effective as a topical agent and as an adjunct to scaling& root planing in treatment of gingivitis and chronic periodontitis.

Aim of study:Determine the periodontal health status in a follow up study for 6 weeks of a group of patients with chronic periodontitis by measuring clinical periodontal parameters, which included (Plaque index, Gingival index, Bleeding on Probing, Probing Pocket Depth and Relative Attachment Level) and to evaluate the effect of intra pocket application of perio Q gel (coenzyme Q10) alone & as adjunct to scaling,& root planing on the periodontal clinical parameters in the management of patients with chronic periodontitis.

Materials and methods: A total of 323 sites with pocket depth (5-8) mm in patients with chronic periodontitis were randomly divided in three groups. The Gel group, 111 sites were treated with intra-pocket application of Perio Q gel alone. In the Combination group, 106 sites were treated with scaling and root planning (SRP) plus intra- pocket application of Perio Q gel, in Scaling and root planing group, 106 sites were treated with scaling and root planing alone. Clinical periodontal parameters such as Plaque index (PI), Gingival index (GI), Bleeding on probing (BOP), Probing pocket depth (PPD), Relative attachment level (RAL) were assessed at first visit, 3weeks and 6weeks.

Results: on intra-group analysis, all groups showed highly significant reduction in PI, GI, BOP, PPD and RAL among the three visits .On inter-group analysis, the results showed significant reduction in the clinical parameters PPD and RAL of combination group in comparison to SRP group.

Conclusion: The results of the research were encouraging and suggested the possibility to use the gel as a sole agent to support standard treatment procedures in periodontitis. The clinical parameters significantly improved in the phase of periodontal treatment, indicating that CoQ10 opens new treatment options by improving the host response to disease activity.

Keyword: Chronic periodontitis, Antioxidants, Coenzyme Q10, Perio Q Gel. (J Bagh Coll Dentistry 2015; 27(2):130-135).

INTRODUCTION

Periodontitis is a silent disease. It is an inflammatory response caused by groups of specific microorganisms in which the structural support to the tooth is destroyed [1,2].

The disease results in resorption of the alveolar bone, destruction of the periodontal ligament supporting the tooth and formation of a periodontal pocket with attachment loss. The pocket provides an ideal environment for the proliferation of a variety of pathogenic bacteria [3].

Successful periodontal treatment is dependent on anti-inflammatory procedure, which includes both mechanical (scaling polishing along with plaque control measures or surgical methods) and chemotherapeutic approach [4]. Chemotherapeutic approach includes local application or sustained release of local drug delivery agents and systemic approaches.

The local delivery therapy to periodontal pockets has the benefit of putting more drug at target site while minimizing exposure of total body to the drug [5].

Locally delivered antioxidant agents are administered to disinfect the root surface and adjacent periodontal tissues and reduction of pocket formation. They are designed to enhance the healing following periodontal therapy [6].

Controlled release delivery of antioxident directly into periodontal pockets has received eminent interest and appears to hold a levelheaded promise in periodontal therapy. It does not substitute conventional mechanical debridement but acts as an adjunct to it. The periodic use of local drug delivery in improving gingival and periodontal condition, would allow better control and management of periodontal disease [7].

Antioxidant material such Coenzyme Q10 is a fat-soluble quinone found in all cells in the body [8]. Primary biochemical action of CoQ10 is a powerful antioxidant that prevents the generation of harmful free radicals that attack the body's defenses and also prevent modifications of proteins, lipids, and DNA [9].Coenzyme Q10 play

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critical role in the generation of (ATP adenosine tri-phosphate) the essential component of energy in the body [10-12].

Also it has a bonus effect with significant reduction of motile rods and spirochetes .Particularly affects the cells of that are most metabolically active: heart, immune system, gingival and gastric mucosa .Research has found it beneficial for cancer, gastric ulcer, aging, physical performance, periodontal disease, muscular disease, neurodegenerative disorders and cardiovascular disease [13].

For all these functions it's used for intra-pockets application as gel form called (Perio Q gel) solitary and also additive with scaling and root planing for the treatment of chronic periodontitis thus, opening new treatment options. The gel is easily prepared and administered. Moreover, they possess a higher biocompatibility and bioadhesivity, allowing adhesion to dental pocket tissues and finally, they can be rapidly eliminated through bloodstream, decreasing the irritation or allergic host reactions in the application site [14],so it have additional activity because of its functions and its form(gel). According to the best of our knowledge, few studies evaluate the clinical effectiveness of this gel as a mono therapy &as adjunct to scaling &root planning in the management of patients with chronic periodontitis, so itwas decided to conduct this study.

MATERIALS AND METHODS

Human Sample

The total patients number was (15), both genders, with an age range (35-55).

Inclusion criteria: Systemically healthy patients, At least had 20 teeth, the patients had chronic periodontitis with at least 4 sites with pocket depth equal or greater than 4mm with clinical attachment loss of 1-2 mm or greater [15].

Exclusion criteria: Pregnant and lactating women, Smokers, Patients received periodontal treatment and used antibiotics or anti-inflammatory medications in the last3months.

The aims and purposes of the study were well explained to the patients so they participated voluntarily in the period between April to the beginning of July 2014.

Study design

A total of 323 sites of the probing depth (5-8) mm were included in the study.

Each patient mouth splitted into three quadrants, each quadrant should have at least 4 pocket sites of (5-8) mm depth. The selected sites were divided into three groups according to the different treatment modalities:

Gel group: these sites treated with intra-pocket application of perio Q gel only without any deep scaling or root planing.

Combination group: these sites treated by both: intra-pocket application of perio Q gel with scaling and root planing.

Scaling and root planning group: these sites treated with scaling and root planing alone

Periodontal examinations were performed before and after three and six weeks after the beginning of the experiment. Periodontal assessments were performed using the Plaque Index (PLI) [16], Gingival Index (GI) [17], Bleeding on Probing (BOP) [15], Probing Pocket Depth (PPD) [18] and Relative Attachment Level (RAL).

Treatment: First, of all an alginate impression was taken and an occlusal stent was constructed for each patient.for the three groups the initial visit (1st day) included Patient selection, supra gingival scaling, alginate impression, motivation and instruction.

Gel group received intra pocket application of perio Q gel only. The selected sites were isolated by cotton rolls, dried the teeth by air, and then dried the pockets by paper point size (30, 35, 40, and 45). The application of the gel was made using disposable syringe of 5ml. The sharp tip of needle was removed by rotary bur to avoid hurting the gingival tissue and smoothened it,then 1 ml of the gel was pulled by the syringe and the needle gently placed down through the pocket then placed the gel.Each pocket was received a range of (0.1-0.3) ml., the excess gel oozing from the pockets was removed .The patients were instructed to avoid spitting, washing, eating and drinking for 2 hours of the gel application. Toothbrush and interdental aids should paused of the day after the gel application.

Combination group: 106 sites in this group received deep scaling and root planing, then after one hour, the patient examined if there was no blood oozing, then the gel applied as was described previously. If not, the patient was referred to the next day.

Scaling and root planning group: received scaling and root planning only.

Data collected after 3weeks and 6weeks. Data obtained after treatment was compared with the initial values. Results were expressed as mean ± SD and Median for Bleeding on probing,t –test &Wilcoxon Signs rank test (WSR) were used

where indicated. The level of significance was 0.05.

RESULTS

Intra-Group comparison:

Gel group

Reduction of mean values of clinical periodontal parameters Plaque index, Gingival index, Probing pocket depth and Relative attachment level in Gel groupamong 3 visits with highly significant differences among three visits of P values (0.00) (Table 1).Bleeding on probing inGel groupamong 3 visits showed highly significant differences among three visits of P values (0.01) (Table 2).

Combination group

Reduction of mean values of clinical periodontal parameters Plaque index, Gingival index, Probing pocket depth and Relative attachment level in Combination group among 3 visitswithhighly significant differences among three visits of P values (0.00)(Table 3).Bleeding on probing in Combination group among 3 visits showed highly significant differences among three visits of P values (0.01) (Table4).

Scaling and Root planing group

Reduction of mean values of clinical periodontal parameters Plaque index, Gingival index, Probing pocket depth and Relative attachment level in Scaling and Root planing group among 3 visits withhighly significant differences among three visits of P values (0.00) (Table 5). Bleeding on probing of Scaling and Root planing group among 3 visits showed highly significant differences among three visits of P values (0.01) (Table 6).

Table 1: Intra-Group comparison of (Plaque index, Gingival index, Probing pocket depth and Relative attachment level) Gel group among the 3visits

Variables	Visits	Descriptive Statistics				1st vs. 2nd		1st vs. 3rd		2nd vs. 3rd	
		Mean	S.D.	Min.	Max.	t-test	p-value	t-test	p-value	t-test	p-value
PI	1st	1.80	0.33	1	2.1	5.737	0.000 (HS)	10.08	0.000 (HS)	5.45	0.000 (HS)
	2nd	1.33	0.37	0.83	2						
	3rd	0.98	0.29	0.5	1.6						
GI	1st	1.99	0.05	1.83	2.09	10.272	0.000 (HS)	13.318	0.000 (HS)	6.984	0.000 (HS)
	2nd	1.59	0.17	1.25	2						
	3rd	1.25	0.24	1	1.63						
PPD	1st	6.75	0.68	5.8	7.8	8.024	0.000 (HS)	13.066	0.000 (HS)	10.313	0.000 (HS)
	2nd	6.23	0.61	5.5	7.3						
	3rd	5.59	0.62	4.6	6.7						
RAL	1st	7.74	0.68	6.8	8.9	7.965	0.000 (HS)	13.244	0.000 (HS)	10.629	0.000 (HS)
	2nd	7.23	0.61	6.5	8.4						
	3rd	6.58	0.62	5.6	7.8						

Table 2: Intra-Group comparison of Bleeding on Probing in Gel group among the three visits

Visits		Descriptive Statistics	1st vs. 2nd		1st vs. 3rd		2nd vs. 3rd	
		Median	WSR	p-value	WSR	p-value	WSR	p-value
0	1st	0	-3.315	0.001 (HS)	-3.417	0.001 (HS)	-3.322	0.001 (HS)
	2nd	2.7						
	3rd	4.5						
1	1st	6.3	-3.329	0.001 (HS)	-3.419	0.001 (HS)	-3.314	0.001 (HS)
	2nd	3.6						
	3rd	2						

Table 3: Intra-Group comparison (PLI, GI, PPD and RAL) of Combination group among the 3visits

Variables	Visits	Descriptive Statistics				1st vs. 2nd		1st vs. 3rd		2nd vs. 3rd	
		Mean	S.D.	Min.	Max.	t-test	p-value	t-test	p-value	t-test	p-value
PI	1st	1.83	0.23	1.5	2	9.272	0.000 (HS)	16.598	0.000 (HS)	5.682	0.000 (HS)
	2nd	1.41	0.31	1	2						
	3rd	1.02	0.20	0.6	1.4						
GI	1st	1.98	0.06	1.75	2	9.265	0.000 (HS)	13.460	0.000 (HS)	6.615	0.000 (HS)
	2nd	1.56	0.17	1.3	1.8						
	3rd	1.20	0.23	1	1.75						
PPD	1st	6.20	0.62	5.5	7.75	10.974	0.000 (HS)	11.182	0.000 (HS)	6.071	0.000 (HS)
	2nd	5.67	0.60	5.16	7.25						
	3rd	5.19	0.71	4.25	6.87						
RAL	1st	7.20	0.62	6.5	8.89	11.138	0.000 (HS)	11.275	0.000 (HS)	6.180	0.000 (HS)
	2nd	6.67	0.60	6.16	8.4						
	3rd	5.75	0.71	5.25	7.98						

Table 4: Intra-Group comparison of Bleeding on Probing in Combination group among the three visits

Visits		Descriptive Statistics	1st vs. 2nd		1st vs. 3rd		2nd vs. 3rd	
		Median	WSR	p-value	WSR	p-value	WSR	p-value
0	1st	0	-3.436	0.001 (HS)	-3.425	0.001 (HS)	-3.191	0.001 (HS)
	2nd	2.8						
	3rd	5.6						
1	1st	5.6	-3.424	0.001 (HS)	-3.425	0.001 (HS)	-3.191	0.001 (HS)
	2nd	3.7						
	3rd	0.9						

Table 5: Intra-Group comparison (PLI, GI, PPD and RAL) of Scaling and Root planing group among the 3visits

Variables	Visits	Descriptive Statistics				1st vs. 2nd		1st vs. 3rd		2nd vs. 3rd	
		Mean	S.D.	Min.	Max.	t-test	p-value	t-test	p-value	t-test	p-value
PI	1st	1.94	0.13	1.57	2	15.194	0.000 (HS)	24.967	0.000 (HS)	7.876	0.000 (HS)
	2nd	1.42	0.19	1	1.6						
	3rd	1.09	0.18	0.7	1.4						
GI	1st	1.98	0.13	1.57	2.2	7.685	0.000 (HS)	16.030	0.000 (HS)	6.503	0.000 (HS)
	2nd	1.54	0.22	1.25	2						
	3rd	1.18	0.17	1	1.42						
PPD	1st	6.40	0.66	5.2	7.28	9.572	0.000 (HS)	9.309	0.000 (HS)	5.701	0.000 (HS)
	2nd	6.10	0.61	4.6	6.7						
	3rd	5.75	0.62	4.2	6.25						
RAL	1st	7.50	0.66	6.2	8.4	9.774	0.000 (HS)	9.266	0.000 (HS)	5.635	0.000 (HS)
	2nd	7.05	0.61	5.6	7.8						
	3rd	6.75	0.61	5.2	7.3						

Table 6: Intra-Group comparison of Bleeding on Probing in Scaling and Root planing group among the three visits

Visits		Descriptive Statistics	1st vs. 2nd		1st vs. 3rd		2nd vs. 3rd	
		Median	WSR	p-value	WSR	p-value	WSR	p-value
0	1st	0	-3.320	0.001 (HS)	-3.420	0.001 (HS)	-3.448	0.001 (HS)
	2nd	2.8						
	3rd	4.7						
1	1st	5.6	-3.301	0.001 (HS)	-3.419	0.001 (HS)	-3.438	0.001 (HS)
	2nd	2.8						
	3rd	1.9						

DISCUSSION

The concept of antioxidant therapy in the treatment of numerous diseases including inflammatory periodontal disease exists in the literature. Because of its function, CoQ_{10} has received much research attention in a medical literature in the last several years. However, there is a dearth of new information regarding CoQ_{10} in the treatment of periodontal conditions [10].

Gel group &clinical periodontal parameters

There was a reduction in the scores of **Plaque index** among the 3 visits with a highly significant differences, this may indicate that the patients maintained their oral hygiene over the period of time of the study.

Also there was a highly significant differences improvement seen in terms of decrease in **Gingival index** scores values and this may indicate the added advantage of coenzyme Q10 gel, in addition to maintaining good plaque control.

A highly significant difference was observed in **Bleeding on Probing** sites with reduction of bleeding sites among the 3 visits of gel treatment and this could be attributed to that CoQ10 serves as an endogenous antioxidant, and its increased concentration in the diseased gingiva effectively suppresses advanced periodontal inflammation. Also when reactive oxygen species (ROS) are scavenged by antioxidants like CoQ10; there can be a reduction of periodontal collagen degradation [19].

It was shown a reduction in **Probing Pocket Depth** and **Relative Attachment Level**which may be due to the antioxidant action and the cumulative effects of CoQ10 as an immune enhancer and accelerates tissue healing [20-22].Healing and repair of periodontal tissue requires efficient energy production, and the metabolic functions of the periodontal tissues depend on an adequate supply of CoQ10, which act as a cofactor in the oxidative phosphorylation production of adenosine triphosphate (ATP)[23]. ATP provides the energy for muscle contraction and other vital cellular functions. The major part of ATP production occurs in the inner membrane of mitochondria where coenzyme Q10 is found [24].

This is accordance with many studies [25,26] &similar results have been reported by others [10,23,27-30]

Combination group & Clinical Periodontal Parameters

There was a reduction in the **Plaque index, Gingival index** and **Bleeding on Probing** scores among the 3 visits with a highly significant differences, this could be related to scaling and root planing that remove all deposits from pockets &eliminate the bacteria with a bonus effect of CoQ10 of significant reduction of motile rods and spirochetes [31].Combination between these two effects may reduce the inflammation.

A highly significant difference &reduction showed in result of **Probing Pocket Depth** and **Relative Attachment Level.** A deficiency of coenzyme Q10 in the gingival tissue may exist independently of and/or because of periodontal disease. If a deficiency of coenzyme Q10 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 coenzyme Q10. In such patients, oral dental treatment and oral hygiene procedures can remove the local factors only but cannot correct the deficiency of CoQ10 due to systemic cause. Thus, mechanical periodontal therapy along with the adjunctive use of CoQ10 can be included for an overall improvement of the gingival health in periodontal disease [32,9].

This result agree with other findings [25,26]. & similar results have also been reported by others [10,23,27-30]

Scaling &Root Planning Group

Scaling & root planing is one of the most commonly used procedures for the treatment of periodontal diseases and it is considered as the gold standard therapy in comparison to other therapeutical procedures. The results of this study showed that there was a highly significant reduction in the scores of **Plaque index, Gingival index, Bleeding on Probing,Probing Pocket Depth** and **Relative Attachment Level** among the 3 visits. These reductions in the clinical periodontal parameters may be due to that scaling is the process by which plaque and calculus are removed from both supra gingival and sub gingival tooth surfaces, while root planing is the treatment procedure that is designed to remove cementum or surface dentin that is rough, impregnated, with calculus or contaminated with toxins or microorganisms.

Therefore, it will results in elimination of disease and return the supporting structures of the teeth to a healthy state. This was In agreement with these studies [10,19,23,33].

As conclusion; the results of the research were encouraging and suggested the possibility to use

the gel as a sole agent to support standard treatment procedures in periodontitis. The clinical parameters significantly improved in the phase of periodontal treatment, indicating that CoQ10 opens new treatment options by improving the host response to disease activity.

Intra-pocket application of Perio Q gel alone and as adjunct with mechanical debridement and mechanical debridement alone were improved the clinical periodontal parameters.

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