An Evaluation of the Effectiveness of Coenzyme Q10 Gel in Management of Patients with Chronic Periodontitis (II inter group comparison)

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ABSTRACT

Background: Anti-oxidants are used as supplements to counteract the over production of free radicals in periodontal disease.Co-Q10 functions as an intercellular antioxidant by acting as a primary scavenger of free radicals (FRs) and reactive oxygen species (ROS), this study aimed to evaluate the effect of intra pocket application of perio Q gel (coenzyme Q10) alone and as adjunct to scaling and root planing on the periodontal clinical parameters in the treatment of patients with chronic periodontitis and compare the better improvement on the clinical periodontal parameters among different treatment modalities at 3 and 6 weeks.

Materials and methods: A total of 323 sites with pocket depth (5-8) mm in patients with chronic periodontitis were randomly divided into 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: Inter-group analysis, showed significant reduction in the clinical parameters PPD and RAL of combination group in comparison to SRP group.

Conclusion: Better improvement of the clinical periodontal parameters had been achieved by using the gel in combination with scaling and root planing instead of using scaling and root planing only.

Keyword: Chronic periodontitis, Antioxidants, Coenzyme Q10, Perio Q Gel (J Bagh Coll Dentistry 2016; 28(1):127-132).

INTRODUCTION

Inflammation represents the response of the organism to a noxious stimulus, whether mechanical, chemical, or infectious. It is a localized protective response elicited by injury or destruction of tissues which serves to destroy, dilute, or wall off both the injurious agent and the injured tissue.

Whether acute or chronic, inflammation is dependent upon regulated humoral and cellular responses, and the molecules considered to mediate inflammation at one time or another are legion [(1)]. Periodontitis is an immuno-inflammatory disease process resulting from the interaction of a bacterial attack and host inflammatory response, causing inflammation of the supporting tissues of the teeth leading to tissue destruction and tooth loss [(2)].

Coenzyme Q10 (Co-Q10; Ubiquinone) is a compound which is naturally found in every cell of the human body. It derives its name from the ubiquitous presence in nature and quinone structure, which is similar to that of vitamin K. It is a fat-soluble compound which forms an important link in the electron transport system of mitochondria [(3)].

True deficiency states are rare but often present with severe health consequences. Numerous disease processes which are linked to low levels of Co-Q10 can benefit from Co-Q10 supplementation including cardiovascular disease, Parkinson's disease, muscular dystrophy, breast and other cancers, diabetes mellitus, male infertility, acquired immunodeficiency syndrome (AIDS), asthma, thyroid disorders, and periodontal disease.

Co-Q10 has been the topic of research interest since 1970s, which experienced a series of trails depicting its anti-inflammatory, anti-oxidant, and immune modulatory activities [(4)].

This research is part II of the original one and it s aimed to compare the better improvement among different treatment modalities of patients suffering from chronic periodontitis with a 6 weeks follow up study.

MATERIALS AND METHODS

The total patients number were 15, both genders, with an age range (35-55), had chronic periodontitis.

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

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

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Each patient mouth splited 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 thePlaque Index (PLI) [5], Gingival Index (GI) [6], Bleeding on Probing (BOP) [7], Probing Pocket Depth (PPD) [8] and Relative Attachment Level (RAL). 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 111 sites received intra pocket application of perio Q gel only.

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. If not, the patient was referred to the next day.

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

Data collected after 3weeks and 6weeks. Data obtained after treatment was compared with the initial values. Details of statistical analysis regarding mean±SD of Plaque Index (PLI), Gingival Index (GI), Probing Pocket Depth (PPD) and Relative Attachment Level (RAL) and Median for Bleeding on probing of each group of treatment modality were mentioned in the first part of the research [9] .Analysis of Variance test (ANOVA) One-Way, LSD test , t –test and Mann Whitney U test were used where indicated. The level of significance was 0.05.

RESULTS

Inter-Group comparison:

Table 1 showed the comparison of the clinical periodontal parameters PLI, GI, PPD and RAL at each visits.

Regarding PLI and GI indices, there were no significant differences among three groups in the three visits. Regarding PPD and RAL, it was showed that there were significant differences among three groups in the 1st and2nd visits and a non-significant difference in the 3rd visit.

Table 2 showed the details of inter-groups comparison of Mean differences for the clinical periodontal parameters (PPD and RAL) between each pairs of groups. Probing Pocket Depth in first visit showed non-significant difference between Gel and Combination groups but showed significant differences between Gel and Scaling and Root planing groups, as well as between Combination and Scaling and Root planing. Second visit showed non-significant difference between Gel and Combination groups but showed significant difference between Gel and Scaling and Root planing groups and between Combination and Scaling and Root planing. RAL in first visit showed non-significant difference between Gel and Combination groups but showed significant difference between Gel and Scaling and Root planing groups, and between Combination and Scaling and Root planing. Second visit showed non-significant difference between Gel and Combination groups but showed significant difference between Gel and Scaling and Root planing groups, and between Combination and Scaling and Root planing groups.

Table 3 showed that in the third visit a significant difference was found between combination and scaling and Root planing in both clinical periodontal parameters (PPD and RAL).

Table 4 showed non-significant differences between each two groups of Bleeding on probing periodontal parameter score 0 and1 in the three visits.

Table 1: Mean and Standard Deviation Values of the Clinical Periodontal Parameters (PLI, GI, PPD and RAL) in Inter-Groups Comparison among the Three Groups by ANOVA Test

Variables	Visits	Groups	Descriptive statistics				Groups' difference d.f.= 44	
			Mean	S.D.	Min.	Max.	F-test	p-value
PLI	1st	Gel	1.80	0.33	1	2.1	1.414	0.254 (NS)
		Combination	1.83	0.23	1.5	2		
		Scaling and RP	1.94	0.13	1.57	2		
	2nd	Gel	1.33	0.37	0.83	2	0.366	0.696 (NS)
		Combination	1.41	0.31	1	2		
		Scaling and RP	1.42	0.19	1	1.6		
	3rd	Gel	0.98	0.29	0.5	1.6	0.957	0.392 (NS)
		Combination	1.02	0.20	0.6	1.4		
		Scaling and RP	1.09	0.18	0.7	1.4		
GI	1st	Gel	1.99	0.05	1.83	2.09	0.076	0.927 (NS)
		Combination	1.98	0.06	1.75	2		
		Scaling and RP	1.98	0.13	1.57	2.2		
	2nd	Gel	1.59	0.17	1.25	2	0.291	0.749 (NS)
		Combination	1.56	0.17	1.3	1.8		
		Scaling and RP	1.54	0.22	1.25	2		
	3rd	Gel	1.25	0.24	1	1.63	0.447	0.634 (NS)
		Combination	1.20	0.23	1	1.75		
		Scaling and RP	1.18	0.17	1	1.42		
PPD	1st	Gel	6.75	0.68	5.8	7.8	3.532	0.038 (S)
		Combination	6.20	0.62	5.5	7.75		
		Scaling and RP	6.40	0.66	5.2	7.28		
	2nd	Gel	6.23	0.61	5.5	7.3	4.130	0.023 (S)
		Combination	5.67	0.60	5.16	7.25		
		Scaling and RP	6.10	0.61	4.6	6.7		
	3rd	Gel	5.59	0.62	4.6	6.7	2.907	0.066 (NS)
		Combination	5.19	0.71	4.25	6.87		
		Scaling and RP	5.75	0.62	4.2	6.25		
RAL	1st	Gel	7.74	0.68	6.8	8.9	3.525	0.038 (S)
		Combination	7.20	0.62	6.5	8.89		
		Scaling and RP	7.50	0.66	6.2	8.4		
	2nd	Gel	7.23	0.61	6.5	8.4	4.221	0.021 (S)
		Combination	6.67	0.60	6.16	8.4		
		Scaling and RP	7.05	0.61	5.6	7.8		
	3rd	Gel	6.58	0.62	5.6	7.8	2.946	0.063 (NS)
		Combination	5.75	0.71	5.25	7.98		
		Scaling and RP	6.19	0.61	5.2	7.3		

Table 2: Inter Groups Comparison of PPD and RAL between Each Pair of the Study Groups Using LSD Test at 1st and 2nd Visits

Variables	Groups		Mean Difference	p-value
1st visit PPD	Gel	Combination	0.001	0.998 (NS)
		Scaling and RP	0.551	0.026 (S)
	Combination	Scaling and RP	0.551	0.026 (S)
2nd visit PPD	Gel	Combination	0.011	0.959 (NS)
		Scaling and RP	0.556	0.016 (S)
	Combination	Scaling and RP	0.545	0.018 (S)
1st visit RAL	Gel	Combination	-0.026	0.914 (NS)
		Scaling and RP	0.539	0.030 (S)
	Combination	Scaling and RP	0.565	0.023 (S)
2nd visit RAL	Gel	Combination	0.004	0.986 (NS)
		Scaling and RP	0.559	0.015 (S)
	Combination	Scaling and RP	0.555	0.016 (S)

Table 3: Inter-groups Comparison between Each Two Groups of the Clinical Periodontal Parameters (PLI, GI, PPD and RAL) and the Significance of Differences by t-Test at Each Visit

Variables	Visits	Groups	Comparison (d.f.=28)	
			t-test	p-value
PLI	1st	Gel x Combination	-0.210	0.835 (NS)
		Gel x Scaling and RP	-1.522	0.139 (NS)
		Combination x Scaling and RP	-1.733	0.094 (NS)
	2nd	Gel x Combination	-0.594	0.557 (NS)
		Gel x Scaling and RP	-0.802	0.429 (NS)
		Combination x Scaling and RP	-0.135	0.893 (NS)
	3rd	Gel x Combination	-0.456	0.652 (NS)
		Gel x Scaling and RP	-1.298	0.205 (NS)
		Combination x Scaling and RP	-1.046	0.304 (NS)
GI	1st	Gel x Combination	0.533	0.598 (NS)
		Gel x Scaling and RP	0.285	0.777 (NS)
		Combination x Scaling and RP	-0.037	0.971 (NS)
	2nd	Gel x Combination	0.410	0.685 (NS)
		Gel x Scaling and RP	0.733	0.470 (NS)
		Combination x Scaling and RP	0.374	0.711 (NS)
	3rd	Gel x Combination	0.593	0.558 (NS)
		Gel x Scaling and RP	0.964	0.343 (NS)
		Combination x Scaling and RP	0.288	0.775 (NS)
PPD	1st	Gel x Combination	0.003	0.998 (NS)
		Gel x Scaling and RP	2.247	**0.033 (S)**
		Combination x Scaling and RP	2.344	**0.026 (S)**
	2nd	Gel x Combination	0.051	0.959 (NS)
		Gel x Scaling and RP	2.496	**0.019 (S)**
		Combination x Scaling and RP	2.472	**0.020 (S)**
	3rd	Gel x Combination	-0.659	0.515 (NS)
		Gel x Scaling and RP	1.751	0.091 (NS)
		Combination x Scaling and RP	2.290	**0.030 (S)**
RAL	1st	Gel x Combination	-0.109	0.914 (NS)
		Gel x Scaling and RP	2.190	**0.037 (S)**
		Combination x Scaling and RP	2.401	**0.023 (S)**
	2nd	Gel x Combination	0.018	0.986 (NS)
		Gel x Scaling and RP	2.512	**0.018 (S)**
		Combination x Scaling and RP	2.516	**0.018 (S)**
	3rd	Gel x Combination	-0.692	0.495 (NS)
		Gel x Scaling and RP	1.740	0.093 (NS)
		Combination x Scaling and RP	2.316	**0.028 (S)**

DISCUSSION

Inter- groups Comparison:

Plaque index among these three groups showed non-significant differences at three visits that indicated the patient maintained oral hygiene to the three quadrants that involved in this study equally, so no differences between the three groups. This agrees with Chaudhry et al. [10] and disagrees with other studies [4,11-13].

Gingival index and Bleeding on Probing showed non-significant differences among these three groups at the three visits. This indicated that the three treatment modalities resulted in reduction of the gingival inflammation ,in addition to that the Coenzyme Q10 have an effect with significant reduction of motile rods and spirochetes [14], also mechanical therapy have an effect that prevent bacteria from easily colonizing so the three treatment modalities have an effect of preventing bacteria.

This result agrees with Chaudhry et al [10] and disagree with other studies [4,11- 13].

Probing pocket depth and Relative attachment level in third visit showed significant differences between combination group and scaling and root-planing group with a better improvement of the combination group. This could be due to the potential additive effect of Coenzyme Q10.This was in agreement with these studies [10,4,11,13].

The improved clinical periodontal parameters in this study could also possibly be credited by improvement in immunity in combating periodontal insult.

Table 4: Inter-Groups Comparison between Each Two Groups of the Clinical Periodontal Parameter (Bleeding on Probing) Scores by Mann-Whitney U test at Each Visit

BOP	Visits	Groups	Comparison	
			Mann-Whitney U test	p-value
0	1st	Gel x Combination	112	0.962 (NS)
		Gel x Scaling and RP	112	0.962 (NS)
		Combination x Scaling and RP	112	0.962 (NS)
	2nd	Gel x Combination	79.5	0.167 (NS)
		Gel x Scaling and RP	81	0.189 (NS)
		Combination x Scaling and RP	101.5	0.639 (NS)
	3rd	Gel x Combination	87	0.288 (NS)
		Gel x Scaling and RP	85	0.252 (NS)
		Combination x Scaling and RP	110.5	0.933 (NS)
1	1st	Gel x Combination	103	0.692 (NS)
		Gel x Scaling and RP	111	0.950 (NS)
		Combination x Scaling and RP	107	0.817 (NS)
	2nd	Gel x Combination	106	0.786 (NS)
		Gel x Scaling and RP	107	0.818 (NS)
		Combination x Scaling and RP	103	0.686 (NS)
	3rd	Gel x Combination	103	0.680 (NS)
		Gel x Scaling and RP	95	0.449 (NS)
		Combination x Scaling and RP	111	0.947 (NS)

All the results of this study disagree with the studies that mentioned the CoQ10 have no place in periodontal treatment [15,16].

Problems

There were certain problems encountered during the present study. The intra-pocket placement of the gel was difficult due to unfavorable thixotropic properties which is a time-dependent shear thinning property. Certain gels or fluids that are thick (viscous) under static conditions will flow (become thin, less viscous) over time when shaken, agitated, or otherwise stressed (Time Dependent Viscosity) [17], although the pocket was filled up thoroughly from its base to the gingival margin.

Other problem was bioavailability of the gel was not known (Bioavailability is defined as the proportion of an orally administered substance that reaches the systemic circulation [18]). It has been found that improving the bioavailability of CoQ10 can be achieved through:

a) Reduction in particle size [19].
b) CoQ10 in oil suspension [20].
c) Novel forms of CoQ10 with increased water solubility [21].

Other problem was the substantively of the gel (pertaining to the capacity of an oral antimicrobial agent to continue its therapeutic activity for a prolonged period of time) [22], as it was neither a sustained release nor a controlled release formulation; therefore, it may have had a short wash out period.

In this study, the gingiva visibly regained the normal color and cohesion. The shallowing of periodontal pockets could also been noted, the decrease in gingival bleeding while brushing teeth, pale gingiva and the subsidence of pain in ailments. The patient that maintained good oral hygiene gave more significant differences than the others did.

As a conclusion; inter-group comparison between SRP group and combination group in PPD and RAL showed significantly reduction of combination group than SRP group. The results from Scaling and Root planing group almost showed similar improvement in clinical periodontal parameters with Perio-Q gel alone group. The benefit is almost using of Q10 alone was proved to reveal good results which has an advantage in patients who cannot be treated by SRP (Systemic diseases).

REFERENCES

1. Battino M, Bullon P, Wilson M, Newman H. Oxidative injury and inflammatory periodontal diseases: The challenge of anti-oxidants to free radicals and reactive oxygen species. Crit Rev Oral Biol Med 1999; 10: 458–76.
2. Prakash S, Sunitha J, Hans M. Role of coenzyme Q10 as an antioxidant and bioenergizer in periodontal diseases. Indian J Pharmacol 2010; 42: 334–7.
3. Ashtaputre Vand Limaye M. Local drug delivery in Periodontics: A tactical entreaty. J Research in Pharmaceutical Sci 2014); 2(1): 6-11
4. Chatterjee A, Kandwal A, Singh N, Singh A. Evaluation of Co-Q10 anti- gingivitis effect on plaque induced gingivitis: A randomized controlled

clinical trial, J Indian Soc Periodontol 2012; 16(4): 539–42.
5. Silness J, Loe H. Periodontal disease in pregnancy. II. Correlation between oral hygiene and periodontal condition. Acta Odontol Scand 1964; 22:112-35.
6. Löe H. The Gingival Index, the Plaque Index and the Retention Index Systems. J Periodontol 1967; 38(6): 610-16. (IVSL).
7. Carranza N, Takei K. Carranza's clinical Periodontology. 11th ed. 2012.
8. Lindhe J, Karring T, Lang N. Clinical periodontology and implant dentistry. 3rd ed. Copenhagen: Munksgaard; 1998.
9. Salih TM, Mahmood MSh. Evaluation of the effectiveness of Coenzyme Q10 gel in management of patients with chronic periodontitis (I intra group comparison). J Bagh Coll Dentistry 2015; 27(2):
10. Chaudhry S, Vaish S, Dodwad V, Arora A. Natural antioxidant :Coenzyme Q10 (Perio Q)TM in management of Chronic Periodontities: A Clinical Study .Int J Dent Health Sci 2014; 1(4):475-84
11. Hans M, Prakash S, Gupta S. Clinical evaluation of topical application of perio-Q gel (Coenzyme Q_{10}) in chronic periodontitis patients. J Indian Soc Periodontol 2012; 16(2): 193–9
12. Zaki NM. Site-specific delivery of the Nutraceutical COQ10 for periodontal therapy .International Journal of Pharmacy and Pharmaceutical Sciences Int J Pharm Pharm Sci 2012; 4: 717-23.
13. Sale ST, Parvez H, Yeltiwar RK, Vivekanandan G, Pundir AJ, Jain P. A comparative evaluation of topical and intrasulcular application of coenzyme Q10 (Perio Q™) gel in chronic periodontitis patients: A clinical study. J Indian Soc Periodontol 2014; 18(4): 461–5.
14. Denny N, Chapple IL, Matthews JB. Antioxidant and anti-inflammatory effects of coenzyme Q10: A preliminary study. J Dent Res 1999; 78:543.
15. Lister RE. Coenzyme Q10 and periodontal disease. Br Dent J 1995; 179(6): 200-1
16. Watts TL. Coenzyme Q10 and periodontal treatment: is there any beneficial effect? Br Dent J 1995; 178(6): 209-13.
17. Chanson H, Aoki S, Hoque A. Bubble entrainment and dispersion in plunging jet flows: Freshwater versus seawater. J Coastal Res 2006; 22(3): 664–77
18. Weis M, Mortensen SA, Rassing MR, et al**.** Bioavailability of four oral coenzyme Q10 formulations in healthy volunteers. Mol Aspects Med 1994; 15: S273-S280.
19. Joshi SS, Sawant SV, Shedge A, Halpner AD. Comparative bioavailability of two novel coenzyme Q10 preparations in humans. Int J Clin Pharmacol Ther 2003; 41: 42-8.
20. Westesen K, Siekmann B. Particles with modified physicochemical properties, their preparation and uses. 2001.
21. Kagan D, Madhavi D. A study on the bioavailability of a novel sustained-release coenzyme Q10-ß-cyclodextrin complex. J Int Med 2010; 11:109-13.
22. Elworthy A, Greenman J, Doherty FM, Newcombe RG, Addy M. The substantivity of a number of oral hygiene products determined by the duration of effects on salivary bacteria. J Periodontol 1996; 67(6): 572-6.