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The adjunctive benefits of omega-3 fatty acids as a daily dietary supplementation in the treatment of chronic periodontitis (Interventional, Comparative, In vivo study)

Ahmad F Mostafa, Fathey A Abo Zaid** and Hazem M Mandour****

Abstract

Objective: The present study was designed to evaluate the adjunctive benefits of dietary supplementation with Omega-3 polyunsaturated fatty acids (N-3 PUFAs) as a host modulating agent in the treatment of patients with moderate chronic periodontitis.

Patients and methods: Thirty healthy, non-smoking and not allergic to fish oil with moderate chronic periodontitis were participated in this randomized clinical study. Patients were randomly divided into two equal groups, (Group A, n = 15) was treated with dietary supplementation of Omega-3 fatty acids (three 300 mg capsules daily for three months) adjunct to scaling and root planning (SRP), while (Group B, n = 15) was treated by placebo (three 300 mg capsules daily for three months) adjunct to scaling and root planning. Periodontal parameters (gingival index, plaque index, pocket depth and clinical attachment level) and C-reactive protein (CRP) level in serum, saliva and gingival crevicular fluid (GCF) were recorded for all patients at baseline, 3 and 6 months.

Results: At baseline there was no statistically significant difference between two groups, but after 3 and 6 months Group A showed a statistically significant reduction in clinical parameters and level of CRP in serum, saliva and GCF than Group B.

** B.D.S, 2007, Faculty of Oral and Dental Medicine, Cairo University, Cairo, Egypt.*
*** Professor, Faculty of Oral and Dental Medicine, Department of Oral Medicine, Periodontology, Oral Diagnosis and Oral Radiology, Al Azhar University, Assuit, Egypt.*
**** Professor, Faculty of Oral and Dental Medicine, Department of Oral Medicine, Periodontology, Oral Diagnosis and Oral Radiology, Al Azhar University, Cairo , Egypt.*

Conclusions: Omega-3 polyunsaturated fatty acids as a host modulating agent can improve the clinical outcome of mechanical therapy on periodontal tissue. C-Reactive Protein level is a useful marker for monitoring disease activity.

Introduction

Periodontitis is a chronic inflammatory disease characterized by destruction of connective tissue and bone support following an inflammatory host reaction secondary to infection by periodontal bacteria[1]. This reaction may induce release of mediators such as arachidonic acid (AA) metabolites, cytokines and enzymes. Besides lipopolysaccharide, a major virulence factor of gram-negative periodontopathogens, induces the release of AA metabolites via the cyclooxygenase and lipoxygenase pathways [1].

C-reactive protein (CRP) as an example of acute-phase proteins whose plasma concentration increase in response to various inflammatory stimuli with synthesis of interleukin-6 (IL- 6), interleukin-1β (IL-1β) and tumor necrosis factor-α (TNF-α), In periodontitis the host responds to the microbial challenge, with a high inflammatory response and increased levels of cytokines like IL-1, IL-6, TNF-α, these mediators found to promote the activation of the acute phase reactants and resulting in elevated levels of CRP[2]. It has been reported that, the elevated levels of CRP in gingival crevicular fluid (GCF), saliva and serum increased proportionately with the increase in severity of periodontal disease and positively correlated with the clinical parameters (gingival index, probing depth, clinical attachment loss) [3].

In this respect, dietary supplement in the form of omega-3 polyunsaturated fatty acids (N-3 PUFAs), containing docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), showed a therapeutic value, as anti-inflammatory as well as protective effects in rheumatoid arthritis, cystic fibrosis, ulcerative colitis, asthma, atherosclerosis, cancer, cardiovascular disease and periodontitis [4]. The beneficial effects of N-3 PUFAs were attributed to a decrease in the production of classic inflammatory mediators such as AA-derived eicosanoids (prostaglandin E_2) and inflammatory cytokines [5]. It has been postulated that, resolution of inflammation as an active process can be regulated by specific mechanisms that restore homeostasis and mediated by endogenous, pro-resolving lipid mediators including resolvins, protectins and maresins generated from omega-3 fatty acids and actively synthesized during the resolution phase of acute inflammation [6]. So, the present randomized clinical trial was conducted to evaluate the adjunctive benefits of dietary supplementation with N-3 PUFAs as a host modulating agent in the treatment of patients with moderate chronic periodontitis.

Patients and Methods

This study was carried out on thirty moderate chronic periodontitis patients (11 females and 19 males, aged from 35 to 53 years old). All patients were selected from those attending at the out-patients clinic of the Department of Oral Medicine, Periodontology, Oral Diagnosis and Oral Radiology, Faculty of Dental Medicine, Boys, Cairo, Al-Azhar University. The criteria implemented for patient inclusion were: **1)** according to dental modified Cornell Medical Index [7] no systemic diseases which could influence the outcome of therapy; **2)** All subjects were not receiving any drug for at least 6 months and not subjected to any surgical periodontal therapy at least one year before sample collection; **3)** Patients with moderate chronic periodontitis (with a CAL 3 - 4 mm or with PD $\geq$ 5 mm, localized < 30% or generalized > 30%) [8]. Pregnant females, smokers and patient allergic to fish oil were excluded from participating in the study.

I. Grouping

Thirty patients were randomly devided into two equal groups:

Group A: received initial periodontal

therapy accompanied with dietary supplementation with 3000 mg fish oil. Each capsule contained 1000 mg fish oil (EPA\DHA 30 % (R)) to be taken orally as 3 capsules daily for three months. Each Omega-3 PUFA capsule contained 180 mg EPA and 120 mg DHA and 100 mg wheat germ oil.

Group B: received initial periodontal therapy accompanied with a placebo capsule containing dietary supplementation as 300 mg Soybean oil. Each capsule contained 100 mg Soybean oil to be taken orally as 3 capsules daily for three months.

II. Intervention

All patients received a complete oral examination for initial documentation, including medical history, dental history, complete periodontal charting, periapical radiographs. The clinical parameters including gingival index (GI), plaque index (PI), clinical attachment loss (CAL) and pocket depth (PD) were measured and the blood, saliva and gingival crevicular fluid (GCF) samples were collected at baseline, 3 months and 6 months to detect level of C - reactive protein (CRP) by using enzyme-linked immunosorbent assay (ELISA) technique, Enzyme Immunoassay Test Kit (IMMUNOSPEC) (*).

III. Treatment procedure:

All patients were subjected to initial periodontal therapy including scalling and root planning (SRP), which performed under local anesthesia in two sessions for the entire dentition. SRP was performed using an ultrasonic scaler and hand instruments. Oral hygiene instructions including tooth brushing, flossing and the use of an interproximal brush were given. Three and six months after SRP, each patient was reexamined again and data were recorded including (GI), (PI), (PD), (CAL) and CRP levels were recorded in Serum, saliva and GCF samples.

IV-Data management and analysis:

Collected data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. Significance of the obtained results was judged at the 5% level.

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** IMMUNOSPEC CO, USA, Scientific Geolab, Cairo.*

Results

At baseline; there was no statistically significant difference in plaque indexes, gingival index, pocket depths and clinical attachment level between the two groups. After 3 and 6 months, Group A showed statistically significantly reduction in mean plaque index score, gingival index score, pocket depth and clinical attachment loss than Group B.

Table (1): Illustrating comparison between the two studied groups according to age and sex data Plaque index, Gingival Index, Pocket depth, and Clinical attachment loss.

	Group A (n = 15)		Group B (n = 15)		Test of sig.	P
Age						
Mean ± SD.	34.67 ± 7.88		37.87 ± 8.71		t= 1.055	0.300
Sex	No.	%	No.	%		
Male	9	60.0	10	66.7	χ^2=2.143	0.143
Female	6	40.0	5	33.3		
Plaque index						
Baseline	2.10	0.10	2.13	0.04	106.5	0.806
3 months	0.37	0.19	0.59	0.14	45.0*	0.004*
6 months	0.20	0.17	0.41	0.12	35.5*	0.001*
Gingival Index						
Baseline	2.10	0.10	2.07	0.08	73.0	0.106
3 months	0.29	0.14	0.60	0.21	26.0*	<0.001*
6 months	0.16	0.10	0.46	0.20	18.0*	<0.001*
Pocket depth						
Baseline	3.99	0.29	3.90	0.26	0.920	0.365
3 months	2.60	0.39	2.87	0.55	2.147*	0.016*
6 months	1.95	0.24	2.21	0.27	2.809*	0.009*
Clinical attachment loss						
Baseline	2.91	0.13	2.74	0.50	763.5	0.147
3 months	0.82	0.33	1.13	0.29	58.5*	0.023*
6 months	0.33	0.24	0.73	0.29	21.0*	<0.001*

t: Student t-test

p: p value for comparing between the studied groups

*: Statistically significant at $p \leq 0.05$

At baseline; there was no statistically significant difference in CRP level in saliva, GCF and serum between the two groups. After 3 and 6 months, Group A showed statistically significantly reduction in mean CRP level in saliva, GCF and serum than Group B.

Table (2): shows salivary CRP conc. (mg/L), Gingival crevicular fluid CRP conc.(mg/L), Serum CRP conc. (mg/L).

	Group A		Group B		t	p
	Mean	±SD	Mean	±SD		
Saliva CRP conc. (mg/L)						
Baseline	4.37	0.70	4.39	0.56	0.083	0.934
3 months	2.70	0.66	3.33	0.45	3.068*	0.005*
6 months	0.91	0.38	2.40	0.62	7.914*	<0.001*
Gingival crevicular fluid CRP conc.(mg/L)						
Baseline	4.64	1.85	5.40	1.33	1.294	0.206
3 months	2.43	0.65	4.03	1.13	4.765*	<0.001*
6 months	0.64	0.27	2.94	0.92	9.356*	<0.001*
Serum CRP conc. (mg/L)						

Baseline	13.10	1.06	13.10	0.50	0.0	1.000
3 months	9.31	1.18	11.41	0.70	5.918*	<0.001*
6 months	5.31	1.25	8.91	0.62	9.976*	<0.001*

t: Student t-test

p: p value for comparing between the studied groups

*: Statistically significant at $p \leq 0.05$

Discussion

The present study showed that, there was a significant reduction in plaque index (PI) scores in both groups during the whole follow up period which may attribute to good motivation and cooperation of patients during the study, at baseline; there was no statistically significant difference between plaque indexes in the two groups, while after 3 and 6 months, Group A showed statistically significantly reduction than Group B which may lend support to known idea that omega-3 could have strong antibacterial activity against a range of oral pathogens and help in controlling plaque formation on tooth surfaces [9]. The mean of gingival index (GI) scores in both groups showed significant reduction at different intervals. At baseline there was no statistically significant difference between gingival index score in the two groups, while after 3 and 6 months, Group A showed statistically significantly reduction in mean of gingival index score than Group B. Suggesting the anti-inflammatory effect of omega-3 fatty acids which are in fact able to down-regulate pro-inflammatory cytokine and production of pro-resolving lipid mediators, resolvins, maresins and protectins [10].

The mean of Pocket Depth (PD) scores changed in the two groups and there was a statistically significant reduction during the whole follow up period as follow, there was no statistically significant difference in pocket depths between the two groups at baseline. But at 3 and 6 months; Group A showed statistically significant reduction in mean pocket depth than Group B. Also, the mean of clinical attachment loss (CAL) scores changed in the two groups as follow, at baseline; there was no statistically significant difference between the two groups. But After 3 and 6 months, Group A showed statistically significantly reduction than Group B. The present results showed to be in agreement with the results of other studies [11-14] who reported the improvement of clinical parameters in the group received daily dietary supplements of omega-3 polyunsaturated fatty acids (N-3 PUFAs) adjunct to scalling and root planning (SRP) more than occur in the group received placebo and SRP.

In the present study, the mean of serum CRP value changed in the two groups, at baseline; there was no statistically significant difference between the two groups, but after 3 and 6 months, Group A showed statistically significantly reduction than Group B. On the other hand, Although the anti-inflammatory effect of omega-3 fatty acids adjunct to scalling and root planning (SRP) was also observed in other study and showed that there was a statistically significantly reduction in clinical measurement in test group more than control one. But serum CRP level in both groups not showed the same significant reduction. The authors contribute this to the use of low dose of omega-3 PUFAs [15]. It is of interesting to mention that, the decrease in clinical parameters showed to be associated with the reduction in serum C- reactive protein (CRP) level and confirmed with other studies when patients treated with daily dietary supplements of omega-3 polyunsaturated fatty acids (N-3 PUFAs) adjunct to scalling and root planning (SRP) rather than when treated with SRP only [16-18].

The present study showed that, the mean of salivary CRP value at baseline; there was no statistically significant difference between the two groups, while after 3 and 6 months, Group A

showed statistically significantly reduction than Group B. Results of the present study were also supported by other study who reported that; there was a correlation between reduction of salivary CRP levels and treatment of periodontal disease [19]. With regard to CRP level in gingival crevicular fluid (GCF), the mean of CRP value in GCF at baseline; showed no statistically significant difference between the two groups. But after 3 and 6 months, Group A showed statistically significantly reduction than Group B. Results of the present study also showed that, the improvement of clinical parameters associated with a reduction in CRP level in gingival crevicular fluid (GCF) was documented by other studies who reported that; there is a correlation between reduction of CRP level in GCF and a decrease of clinical parameters occurs in periodontal tissue [20-22].

Conclusions and Recommendations:

1. Omega-3 polyunsaturated fatty acids can improve the clinical outcome of mechanical therapy on periodontal tissue.

2. CRP level is a useful marker for monitoring disease activity.

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