

# Systemic Lycopene as an adjunct to Non-Surgical Periodontal Therapy in Generalized Chronic Periodontitis

## Research Article

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## Abstract

**Aim:** To evaluate the potency of systemic anti-oxidants in the non-surgical treatment of generalised chronic periodontitis. **Objective:** Purpose of this short term clinical study is to ascertain whether or not daily systemic supplementation of antioxidants adjunctively used after scaling and root planing (SRP) would improve clinical condition in generalised chronic periodontitis using C-reactive protein (CRP) as inflammatory markers and chronic periodontitis treatment index needs (CPTIN Index) to evaluate reduction in periodontal pockets. **Results:** Each group involved 10 participants with age group 30-65 years. The test group was provided with treatment with 20 mg Lycopene once daily after 24 hours of completion of scaling and root planing. The CRP value at baseline ranged from 3- 6.2 with a mean value of  $4.87 \pm 1.09$ . After one month of treatment, the CRP value ranges between 1.1- 4.8 with a mean value of  $3.10 \pm 1.05$ . This clearly indicates a significant decrease in CRP with t value 10.83 and  $>0.00$  p value. The CRP value of control group at baseline ranged from 3-5.9 with a mean value of  $4.58 \pm 1.08$ . After one month of treatment with scaling and root planing, the CRP value ranges to 2.2- 5.4 with a mean value of  $3.96 \pm 1.08$ . This clearly indicates a significant decrease in CRP with t value 13.29 and  $> 0.00$  p value. **Conclusion:** Lycopene as an antioxidant is a promising treatment modality as an adjunct to full mouth scaling. It helps to modulate oxidative stress in periodontium during periodontitis. It also leads to maintenance of periodontal health.

**Key Words:** CPTIN index, C - reactive protein, Periodontitis, Lycopene, Oxidative stress.

## Introduction

Periodontitis is an inflammatory process which is initiated by plaque biofilm that results in destruction of teeth supporting periodontal tissue and ultimately leading to tooth loss. The disease is induced by some specific group of microorganisms which causes progressive destruction of periodontium over a period of time. The progression of periodontitis appears to be dependent on abnormal host response to biofilm organisms (1). Inflammatory response due to periodontitis activates the innate immune response system and adaptive immune system (2). Once the immune system is activated, it leads to release of cytokines and other mediators which further help in propagation of inflammation. Various inflammatory cascades lead to the destruction of periodontium which further leads to periodontitis.

Free radicals and oxidative stress play a significant role in the pathogenesis of periodontal disease. Therefore, lot of attention has been paid

recently to oxidative stress and free radicals. In biological systems, free radicals are mainly the products of oxygen-: Superoxide anion radical ( $O_2^-$ ), Hydrogen peroxide ( $H_2O_2$ ), Hydroxyl radical (OH), Peroxy radical (OOH), Alkoxy radical (RO), Peroxyl radical (ROO) (3). These free radicals are frequently formed as metabolic by products in physiological processes (4) and prove destructive when generated during the respiratory burst as it represents an important pathogenic mechanism for tissue damage and diseases associated with phagocytic infiltration (3).

The oxidative killing mechanisms of neutrophils and other phagocytes involve the formation of ROS (reactive oxygen species). ROS affects periodontal tissues by (5)

- Ground substance degradation
- Enhances Collagenolysis either directly or indirectly or as a result of oxidation of proteases.
- Stimulation of excessive proinflammatory cytokine release through NF- $\kappa$ B (Nuclear factor kappa light chain- enhancer of activated b-cells)

Oxidative stress is a condition that occurs when free radicals overcomes the mechanism of antioxidants protection of an organism and cause rapid oxidative modifications of cellular and extracellular biomolecules such as proteins, carbohydrates, lipids and Deoxyribo Nucleic Acid (4).

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*Shilpa Kamra et al., Systemic Lycopene : A Boon to Patients Suffering from Chronic Periodontitis*

An antioxidant is any substance present in low concentrations in comparison with a substrate, which is oxidised and that significantly delay or prevent oxidation. Hence, it offers protection against destructive effects of free radicals.

The discovery of the role of free radicals in cancer, diabetes, cardiovascular diseases, ageing and other chronic diseases has led to a medical revolution comprising of various antioxidants that is promising new opportunities to heal destruction caused by free radicals.

Hence, antioxidants are emerging as prophylactic and therapeutic agents. Lycopene belongs to a class of compounds known as carotenoids which are yellow, orange and red pigments in plants. Tomatoes are known to be its greatest source. Lycopene attach itself to chemical species that react to oxygen and this unique property makes it most efficient oxidizing agent (7).

CRP was discovered by Tillet and Francis 1930, as precipitation was observed with addition of pneumococcal C-polysaccharide to serum of a patient with acute Pneumonia in Oswald’s fluery laboratory (7). CRP is a pentameric protein with homologs in vertebrates and many invertebrates that participate in the systemic response to inflammation (8). Various studies have demonstrated that CRP levels are elevated in the severe chronic periodontitis subjects (9). ROS release causes increase in levels of systemic inflammatory markers such as CRP has been found in patients with periodontal disease, which further culminate increased oxidative stress in gingival tissue, periodontal ligament and alveolar bone.

This short term investigative study was done to ascertain whether or not daily systemic supplementation of antioxidants adjunctively used after scaling and root planing would improve the clinical conditions of periodontitis. CRP levels were measured before and after lycopene therapy to determine the oxidative stress and inflammatory status after lycopene therapy. CPITN Index was used for clinical correlation to periodontal pockets.

**Materials and Methods**

A short term clinical trial on chronic periodontitis patients was carried out for a period of 1 month. 20 systemically healthy patients between the age group 30-65 years, both male and female were included for the study. Patients were selected from outpatient department of Periodontology, SGT dental college, Gurugram

**Inclusion criteria**

- Systemically healthy patients in the age group of 30-65 years included in study
- Subjects who had not taken antibiotic therapy within 6 months of duration
- Subjects who are not taking antioxidants
- Subjects with minimal 20 natural teeth
- Subjects with chronic periodontitis with raised CRP levels >3mg/l with periodontal pockets

- Only those subjects were included in the study who agree to sign an informed consent

**Exclusion criteria**

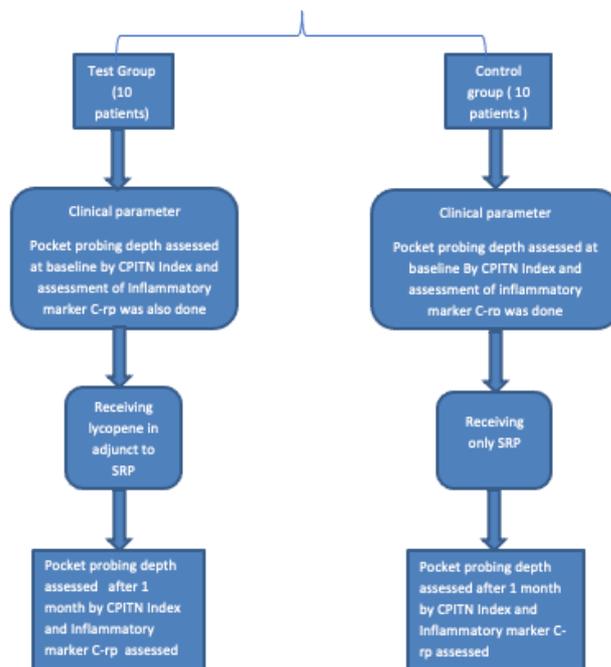
- Subjects who have any systemic disease
- Subjects on antibiotic therapy or were on antibiotic for the last 6 months.
- Subjects who are already taking antioxidants
- Subjects with less than 20 natural teeth
- Subjects who had undergone periodontal therapy

**Test group:** 10 patients were treated with full mouth scaling and root planing then they were advised to take systemic lycopene (20mg) with 24 hour completion of scaling and root planing.

**Control group:** 10 patients were treated with full mouth scaling and root planing

**Diagrammatic representation of study work**

20 systemically healthy individuals diagnosed as generalised chronic periodontitis patients including both male and female patients aged between 30-65 years



**Results**

The study was done among 2 groups of 10 participants each. The test group was treated with scaling, root planing and lycopene. Control group was provided with scaling and root planing. All the participants were involved and there was no drop out after one month of recording base line data. The systemic inflammation and periodontal pocket depth were assessed with the help of CRP and CPITN respectively. The symptoms were assessed at baseline and then after one month for any improvement with the management provided.

The control group were provided treatment with scaling and root planing, involves 10 participants with age group ranging from 30-65 years. The CRP value at

baseline ranged from 3- 5.9 with a mean value of 4.58± 1.08. After one month of treatment with scaling and root planing, the CRP value ranges to 2.2- 5.4 with a mean

value of 3.96 ± 1.08 (Table 1). This clearly indicates a significant decrease in CRP with t value 13.29 and > 0.00 p value.

**Table 1: CRP Value for control Group**

	Mean	N	Std. Deviation	Std. Error Mean	p-Value
CRP VALUE- AT BASELINE (n=10)	4.580	10	1.0809	0.3418	0.000
CRP VALUE AFTER 1 MONTH (After scaling and root planing)	3.960	10	1.0803	0.3416	

The test group provided treatment with scaling, root planing and lycopene as an adjunct to non surgical treatment. The CRP value at baseline ranged from 3- 6.2 with a mean value of 4.87± 1.09. After one month of treatment with scaling and root planing, the CRP value ranges to 1.1- 4.8 with a mean value of 3.10 ± 1.05. (TABLE 2) This clearly indicates a significant decrease in CRP with t value 10.83 and > 0.00 p value.

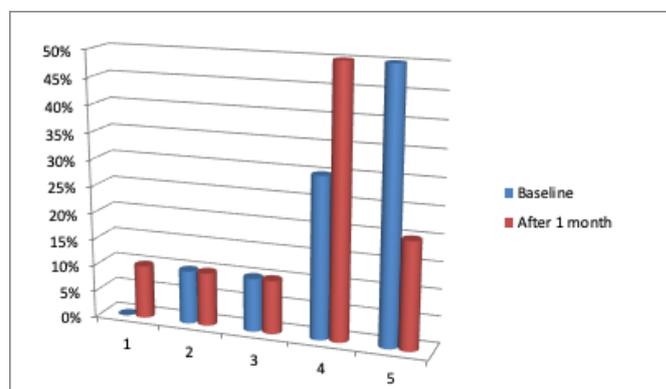
**Table 2: CRP Value for Test Group**

	Mean	N	Std. Deviation	Std. Error Mean	p-Value
CRP VALUE AT BASELINE (n=10)	4.870	10	1.0965	0.3467	0.000
CRP VALUE AFTER 1 MONTH (SRP + lycopene)	3.100	10	1.0520	0.3327	

The dentition was divided into six sextants (one anterior and two posterior regions in each dental arch). The severity of periodontitis has been determined by the CPITN (10) -:

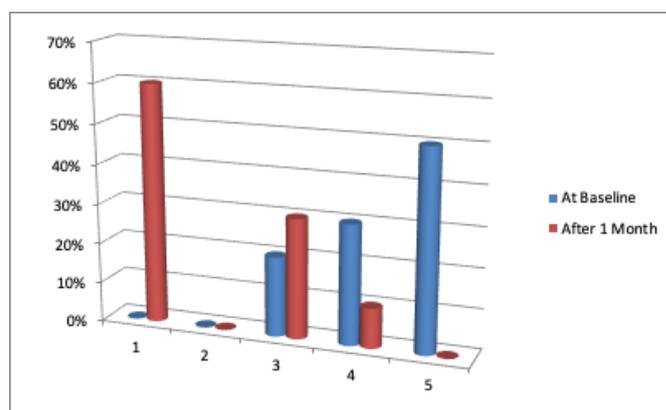
- Code 0 is given to a sextant with no sign of pocket or calculus and bleeding on probing (gingival health with no treatment needs).
- Code 1 is given to a sextant with no pockets, calculus or overhangs of fillings but in which bleeding occurs after gentle probing in one or several gingival units (mild gingivitis; improvement of oral hygiene is needed).
- Code 2 is assigned to a sextant if there are no pockets exceeding 3 mm, but in which, dental calculus and plaque-retaining factors are seen or recognized in sub-gingival regions (established gingivitis; scaling, removal of overhangs, and improvement of oral hygiene is needed).
- Code 3 is given to a sextant that harbors 4-5 mm deep pockets (mild periodontitis, scaling, removal of overhangs, and improvement of oral hygiene is needed).
- Code 4 is given to a sextant that harbors pockets 6 mm deep or deeper (periodontitis and complex treatments such as surgery is needed).

The assessment at baseline with CPITN indicated that all the participants in the group were having periodontal diseases (control as well as test group). In control group, there was one subject with Score 1, one with Score 2, three subjects with Score 3 and five subjects with Score 4. After the treatment of one month with scaling and root planing, 2 subjects came in to score 4 and 5 subjects came under score 3 and 3 subjects came under score 0 (Graph 1) This clearly indicates significant reduction in periodontal disease among participants after scaling and root planing with p value 0.02.



**Graph 1: CPITN Score for control group**

In test group, there were two subjects with score 3, three subjects with score 4 and five subjects with score 5. After the treatment of one month with SRP and lycopene therapy, 5 subjects came under code 1, 2 subjects came under code 3, 1 subject came under Code 4, 2 subjects came under code 0 and no subjects came under code 5 (Graph 2) This clearly indicates reduction in periodontal diseases among participants of scaling and root planing with p value 0.15.



**Graph 2: CPITN Score for Test Group**

Hence, both the treatments groups have shown reduction in periodontal diseases. The control group has shown significant reduction in CRP with a value of 0.62

and the test group with SRP and lycopene therapy has shown a more reduction of 1.77 in CRP value. (Table 1 and 2) The decrease is more in the group with scaling and root planing but the results are comparable.

Both the groups have shown similar or comparable results in the case of CPITN. The control group was five subjects under score 5, which improved to two subjects after one month of treatment. (Graph 1) The test group having five subjects under score 5, which improved to none of the people after one month of treatment. (Graph 2).

## Discussion

Chronic periodontitis is a inflammatory disease that destroys the connective tissue as well as alveolar bone support of the teeth as suggested by Kornman in a report (12). The immune-inflammatory response and biochemical changes caused by innate immunity are the prime factors that play a specific role in pathogenesis of periodontal disease. The Polymorphonuclear (PMN) leukocytes act as the primary mediators of the host response against proliferating periodontal pathogenic microorganisms. Large amount of ROS are produced by activated PMS which subsequently result in destruction of periodontal tissues (13). ROS causes destruction of connective tissue in variety of ways such as peroxidation of proteins, lipids and DNA but when antioxidant systemic supplementation is done; it combats destruction caused by free radicals.

A high plasma level of CRP was observed in severe periodontitis as compared to health. Also, It has been proved that ROS production influence the level of CRP production in the body (14). Hence, this proves that inflammation, free radical production and CRP levels are related to each other. It has been observed in this study also that as subjects of our study approached towards health the CRP level gets reduced.

SRP remains the perfect gold standard for treatment of periodontitis (15). In the present study 20 mg lycopene in the form of soft gel was used as an adjunct to SRP. Soft gels are very much similar to capsules, different from tablets, with longer shelf life and material is made of gelatine. Reddy P, Ambatti M and koduganti R (16) conducted a study research to compare the efficacy of systemic antioxidant therapy with lycopene as an adjunct to scaling and root planing versus scaling and root planing alone in chronic periodontitis patients with type 2 diabetes mellitus and they concluded that lycopene as an adjunctive treatment was effective in reducing oxidative stress and restoring altered glycemic levels. Mohan M, Jhingran R, Bains VK, Gupta V, Madan R, Rizvi I and Mani K (17) selected 40 diabetic subjects with periodontitis and 20 students were allotted to test group and 20 students were allotted to control group, subsequently, the Test group patients underwent scaling and root planing with administration of lycopene 8 mg and control group patients were treated with scaling and root planing alone. Inter-group comparison showed group A giving statistically significant results in reducing mean serum markers at 2 months and 6 months, and in reducing mean PD (mm) and mean HbA1c (%) levels at 2

months ( $P < 0.005$ ). Adinarayan R, Sharma R, Tuteja J, Singh A, Sarmah A (3) performed a research to evaluate the efficacy of systemic lycopene among the gutka chewers with chronic periodontitis with an aim to ascertain whether or not daily systemic supplementation of antioxidants adjunctively used after SRP would improve the clinical condition of chronic periodontitis among gutka chewers using CRP as inflammatory biomarker. The test group (n=10), was treated with lycopene/day 5000mcg with SRP and control group (n=10) was treated with SRP alone. Periodontal parameters were recorded subsequently at baseline, after 1 month of treatment and after 3 months of treatment. It was concluded from the results that the CRP levels were significantly reduced between the Control group and Test group which means signifies that Lycopene along with nonsurgical periodontal therapy was effective in combating oxidative stress. Castro MM, Duarte NN, Nascimento PC, Magno MB Magno, Fagundes NCF Carlos Flores-Mir, Monteiro MC, Rösing CK, Maia LC, and Lima RR (18) performed a systematic review with meta-analysis with an to evaluate the effect of antioxidants as an adjuvant in periodontitis treatment. PubMed, Scopus, Web of Science, Cochrane, Lilacs, OpenGrey, and Google Scholar databases were consulted. These results suggested that the use of antioxidants as an adjunctive approach to nonsurgical periodontal therapy may be helpful in controlling the periodontal disease progression.

In the present study, systemic lycopene 20 mg, once daily for 1 month was prescribed as an adjuvant to SRP and also serum CRP was done to evaluate the oxidative stress. The reduction in oxidative stress among chronic periodontitis patients was reflected by reduction in CRP levels and subsequent improvement in CPITN scores in control as well as test group but there was more reduction in CRP levels and more improvement in CPITN scores in test group as compared to control group which proves that Lycopene can be used as an adjunct to non surgical periodontal therapy so as to reduce inflammation and oxidative stress among chronic periodontitis patients.

## Conclusion

The results shows that Lycopene as an antioxidant is a promising treatment modality as an adjunct to SRP to treat patients suffering from Chronic periodontitis by non-surgical modality. Lycopene helps to modulate oxidative stress as well as helps to block progression of inflammation in periodontal tissues.

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