World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(REVIEW ARTICLE)

Check for updates

The effect of Coenzyme Q10 on Periodontitis

Anastasya Laila Definia Salsabila * and M. Daffa Refasyah Putra

Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia.

World Journal of Advanced Research and Reviews, 2025, 28(02), 1919-1924

Publication history: Received on 10 October 2025; revised on 19 November 2025; accepted on 21 November 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.28.2.3570

Abstract

Background: Periodontitis is a chronic infectious disease that affects the supporting tissues of the teeth. Bacterial infection leads to inflammation of the periodontal tissues and gradually damages them through the inflammatory process. Coenzyme Q10 is an antioxidant agent that can suppress the inflammatory process in the periodontium.

Purpose: This article was aimed to study the effect of Coenzyme Q10 on periodontitis.

Review: Periodontitis is classified into chronic periodontitis and aggressive periodontitis. Chronic periodontitis commonly occurs in adults, while aggressive periodontitis develops in younger individuals with rapid bone loss. Local factors such as plaque and calculus play a role in the development of this disease. Early treatment is important to prevent tooth loss and negative impacts on general health. Coenzyme Q10 is an antioxidant compound that helps protect the body from oxidative damage. The effect of coenzyme Q10 on periodontitis has been proven by the reduction of PI, GI, BI, CAL, and PD as indicators of periodontitis.

Conclusion: After comparing several articles discussing, the effects of coenzyme Q10 on periodontitis, it has been proven that coenzyme Q10, whether in the form of gel or oral supplements, is effective in treating periodontitis. This is evidenced by the decrease in the average values of clinical parameters such as PI, BI, GI, PD, and CAL after one week up to a maximum of three months of treatment. Coenzyme Q10 can work more effectively when its application is accompanied by scaling and root planing (SRP). Coenzyme Q10, as an antioxidant, has been proven to be very effective in treating periodontitis, both general periodontitis and chronic periodontitis. Additionally, coenzyme Q10 also works well and effectively in various patient conditions.

Keywords: Periodontitis; Coenzyme Q10; Antioxidant; Reactive oxygen species; Periodontal therapy

1. Introduction

Periodontitis is a chronic infectious disease that affects the supporting tissues of the teeth. Bacterial infection induces inflammation in the periodontal tissues and gradually damages them through the inflammatory process [1]. If left untreated, periodontitis will progress and eventually lead to adverse outcomes such as tissue destruction, periodontal bone loss, tooth loss, and masticatory dysfunction [2]. Various types of molecules are believed to play a role in the inflammatory response at any given time. Among these molecules, free radicals and reactive oxygen species (ROS), such as superoxide anion radicals, hydrogen peroxide, hydroxyl radicals, and hypochlorous acid, are also recognized as damaging agents. All these molecules are capable of injuring cell membranes or related biomolecules. Periodontal pathogens can induce excessive production of reactive oxygen species, thereby leading to collagen degradation and periodontal cell damage [3].

* Corresponding author: Anastasya Laila Definia Salsabila

Reactive oxygen species play a significant role in the pathogenesis of periodontal disease. They are essential for bacterial killing within cells, but they can also cause damage to extracellular tissues. This tissue damage can occur directly through increased oxidative stress or indirectly by triggering a pro-inflammatory state. These reactive oxygen species can be neutralized by antioxidants, which reduce collagen degradation. Therefore, antioxidants represent promising prophylactic and therapeutic agents. Antioxidants delivered through diet, systemic administration, local application, and dentifrice formulations have been shown to provide significant improvements in the clinical parameters of gingivitis, periodontitis, and oxidative injury [4]. One example of such antioxidants is Coenzyme Q10. Coenzyme Q10 was first discovered in the mitochondria of bovine heart tissue at the University of Wisconsin [5]. It is also known as ubiquinone due to its widespread presence in nature and its quinone structure, which resembles that of vitamin K [6].

Coenzyme Q10 is referred to as a coenzyme because of its ability to participate in chemical reactions while maintaining a stable level within the cell, and it plays a crucial role in energy metabolism [7]. The effects and mechanisms of Coenzyme Q10 include stabilization of calcium-dependent channels, inhibition of intracellular phospholipases, modulation of prostaglandin metabolism, scavenging of free radicals, and direct stabilization of membranes [8]. Coenzyme Q10 plays a pivotal role in the formation of adenosine triphosphate (ATP) and in cellular respiration. It exists in two molecular forms: ubiquinone, the oxidized form, and ubiquinol, the reduced form. Both forms are essential for its antioxidant properties. Coenzyme Q10 functions as an intercellular antioxidant by serving as a primary scavenger of free radicals and reactive oxygen species. Acting as an endogenous antioxidant, increased concentrations of Coenzyme Q10 in diseased gingival tissues can effectively suppress periodontal inflammation [9].

Purpose of the study

This research was aimed to study the effect of Coenzyme Q10 (CoQ10) as an antioxidant in the treatment of periodontitis, focusing on its role in reducing oxidative stress, suppressing periodontal inflammation, and improving clinical parameters such as plaque index (PI), gingival index (GI), bleeding index (BI), probing depth (PD), and clinical attachment loss (CAL).

Research Objectives

The research objectives of the study were

- To evaluate the role of Coenzyme Q10 in reducing oxidative stress and reactive oxygen species (ROS) in periodontal tissues.
- To assess the effect of Coenzyme Q10 on clinical parameters of periodontitis, including PI, GI, BI, PD, and CAL.
- To analyze the effectiveness of Coenzyme Q10 as an adjunctive therapy when combined with scaling and root planing (SRP).
- To examine the potential differences in the therapeutic effectiveness of Coenzyme Q10 between systemic (oral supplements) and local (gel or intra-pocket) applications.

Research Questions

The study sought to answer the following questions

- How does Coenzyme Q10 reduce oxidative stress and reactive oxygen species in periodontal tissues?
- How does Coenzyme Q10 influence clinical parameters of periodontitis such as PI, GI, BI, PD, and CAL?
- How effective is Coenzyme Q10 as an adjunctive therapy when combined with scaling and root planing (SRP)?
- How do different application methods of Coenzyme Q10 (systemic vs local) affect its therapeutic outcomes in periodontitis treatment?

2. Literature review

2.1. Periodontitis

Periodontitis is a chronic multifactorial inflammatory disease associated with the accumulation of dental plaque and characterized by the progressive destruction of the supporting structures of the teeth, including the periodontal ligament and alveolar bone. This disease involves a complex dynamic interaction between specific bacterial pathogens, a destructive host immune response, and environmental factors such as smoking [10]. It is crucial to treat this disease promptly because it not only leads to tooth loss but can also affect the patient's general health.

Periodontitis can be classified into chronic periodontitis and aggressive periodontitis. Chronic periodontitis cases are commonly associated with the presence of abundant plaque and calculus [11]. In contrast, aggressive periodontitis is characterized by familial aggregation and rapid periodontal destruction despite minimal local factors [12]. Aggressive periodontitis is further categorized into localized aggressive periodontitis and generalized aggressive periodontitis.

Chronic periodontitis is more prevalent in adult populations but may also occur in younger patients [13]. The rate of disease progression correlates with the number of local factors present. The development of chronic periodontitis progresses at a slower pace and is associated with specific microbial bacteria. Familial aggregation and neutrophil abnormalities are not linked to chronic periodontitis. Common signs of gingival inflammation are present, with periodontal pocket depths ranging from 4 to 12 mm [14]. Clinical features such as attachment loss and gingival bleeding associated with the disease are often overlooked by patients due to its asymptomatic nature. One of the hallmarks of this disease is the absence of symptoms [13].

Compared to chronic periodontitis, aggressive periodontitis has several distinctive characteristics that facilitate its diagnosis. In 1971, Baer et al. defined aggressive periodontitis as a "periodontal disease occurring in otherwise healthy adolescents, characterized by rapid alveolar bone loss around more than one permanent tooth in the dentition." The presence of local factors such as calculus is not proportional to the extent of periodontal tissue destruction [15]. Classic case presentations of aggressive periodontitis include early onset of the disease, vertical bone loss affecting molars and incisors leading to tooth mobility, familial aggregation, and rapid disease progression. Aggressive periodontitis is categorized into localized aggressive periodontitis, characterized by bone loss involving permanent molars and incisors, and generalized aggressive periodontitis, which affects the majority of permanent teeth [12].

2.2. Antioxidant

Before discussing antioxidants, it is important to first understand the concept of oxidants, since antioxidants are their antithesis. In traditional terminology, oxidants are described as chemicals that can oxidize other substances, or more simply, as agents capable of removing electrons from a substrate molecule. Antioxidants, on the other hand, are equivalent to reductants, meaning molecules that donate electrons to substrate molecules. The term also encompasses molecules that appear to counteract the effects of oxidants. They can be defined as "substances which, when present at low concentrations compared to those of an oxidizable substrate, significantly delay or inhibit the oxidation of that substrate" [16].

Although antioxidants in vitro appear to react directly with oxidants, there is evidence that antioxidants in vivo interact with entire systems, organs, or cells of the body to produce seemingly similar effects, such as reducing oxidative biomarkers [17]. Therefore, a consensus view has emerged that compounds referred to as antioxidants in simple in vitro experiments should rather be considered micronutrients in more complex in vivo situations [18]. Within the body, compounds known as reactive oxygen species (ROS) are constantly generated, a broad term that includes oxidizing species with stable paired electrons, unstable paired electrons, and true free radicals. These natural oxidants function as useful agents in the body, being involved in immune responses and signaling.

Antioxidants can be categorized in various ways, including by their chemical properties, site of action, or source [19]. The effectiveness of all antioxidants depends on their localization and the nature of the oxidative challenge. Other critical factors include cooperative interactions with other antioxidant species and environmental conditions that may render antioxidant activity less relevant. Antioxidants are naturally present in the body to prevent harmful oxidative damage, regulate the production of natural oxidants, and maintain redox homeostatic balance. Oxidative stress occurs only when the balance between oxidants and antioxidants is disrupted, especially when oxidant activity exceeds the capacity of antioxidant defense systems, leading to oxidative damage.

2.3. Coenzyme Q10

Coenzyme Q10 is a fat-soluble antioxidant compound. It is used to inhibit damaging molecules such as reactive oxygen species (ROS), free radicals, and others that may harm the body's defense systems, DNA, lipids, proteins, and cell membranes [2]. Coenzyme Q10 is located within both mitochondrial and extra-mitochondrial structures. It has two distinct oxidation states: the oxidized form (ubiquinone) and the reduced form (ubiquinol).

Within the mitochondria, Coenzyme Q10 is found in the inner membrane, where it transports electrons from complexes I and II to complex III, thereby providing the energy required for proton translocation into the intermembrane space. CoQ10 transfers two electrons to cytochrome c at complex III in the electron transport chain [20]. In this process, ubiquinol donates the first electron to the Rieske iron–sulfur protein. In doing so, the reduced form of CoQ10 (ubiquinol) is oxidized to ubiquinone. The reduced form (ubiquinol) can then be regenerated by receiving electrons either from

complex I or II in the electron transport chain, or from other sources such as acyl-CoA dehydrogenase. The electron transfer flavoprotein (ETF) and the ETF-ubiquinone oxidoreductase (ETF: QO) are key components in donating electrons from a series of dehydrogenases to ubiquinone in the respiratory chain [21]. The redox cycle of ubiquinol converting to ubiquinone and back again, while simultaneously acting as an electron carrier that supports proton pumping, is known as the Q-cycle [20].

3. Results and discussion

This review article discusses the effect of coenzyme Q10 on periodontitis. Periodontal disease is an inflammatory condition caused by bacterial infection and the host's inflammatory response [22]. Periodontitis is not only confined to the oral cavity, but it is also related to mental health. For instance, under stress, the symptoms of periodontitis may emerge and aggravate the disease condition. The severity of periodontitis is assessed using several clinical indicators, including plaque index (PI), gingival index (GI), clinical attachment loss (CAL), bleeding index (BI), and pocket depth (PD).

In clinical applications, coenzyme Q10 functions as an endogenous antioxidant that increases drug concentration in the gingiva affected by periodontitis and effectively suppresses inflammation. This is due to the rapid electron-donating and -accepting properties of coenzyme Q10 [23]. Several studies have reported that coenzyme Q10 in gel form plays an important role in the treatment of periodontitis. Research conducted by Raut demonstrated that intra-pocket application of coenzyme Q10 is more effective than topical administration in managing periodontitis [2]. The study was conducted through systematic searching, followed by screening and analysis, involving 769 sites in this meta-analysis. The results were considered accurate, as evidenced by the reduction in PI scores in the studies. Additionally, coenzyme Q10 also showed significant effects on other periodontal indicators, particularly CAL, which is regarded as more accurate and demonstrated significant improvement. Reports also indicated that coenzyme Q10 gel had a significant and effective impact on GI. Pooled analysis further showed noticeable reductions in BI and PD following the use of coenzyme Q10 gel. In other words, this meta-analysis confirmed the beneficial effects of coenzyme Q10 on periodontitis, as demonstrated by reductions in PI, GI, BI, CAL, and PD.

This meta-analysis was supported by a study involving 40 patients, where intergroup comparisons showed substantial decreases in PI and GI among smokers with periodontitis [24]. Moreover, coenzyme Q10 use was also associated with significant reductions in BI. These three indicators improved after one to three months of coenzyme Q10 administration. Despite patients' dependence on smoking, coenzyme Q10 remained effective in promoting periodontal healing. The study highlighted that coenzyme Q10 acts as an antioxidant that continuously serves as an energy carrier, inhibiting lipid peroxidation by preventing the production of lipid peroxyl radicals. Furthermore, the antioxidants contained in coenzyme Q10 helped mitigate the harmful effects of tobacco substances. The study concluded that the effectiveness of coenzyme Q10 differs significantly between smokers and non-smokers.

The efficacy of coenzyme Q10 in periodontitis treatment was further supported by a split-mouth study conducted in 20 chronic periodontitis patients over one week, which showed that the application of coenzyme Q10 after scaling and root planing (SRP) significantly reduced periodontal indicators [25]. In other words, the use of coenzyme Q10 was considered successful. Although the same coenzyme was used, its application proved effective in both general and chronic periodontitis. Furthermore, Manthena et al. reported that oral supplementation of coenzyme Q10 reduced symptoms of gingival inflammation (gingivitis), which is the precursor of periodontitis, thereby preventing the progression to chronic periodontitis [26]. In other words, coenzyme Q10 in oral supplement form can alleviate gingival inflammation. Since gingivitis represents the early stage of periodontitis, it is strongly recommended to treat it promptly with coenzyme Q10 to prevent further disease progression.

In terms of periodontal parameters, statistical comparisons of mean values before and after treatment demonstrated highly significant improvements. Prior to treatment, the mean values of clinical parameters were very high, whereas after treatment with coenzyme Q10, these values decreased significantly. Studies on coenzyme Q10 were also conducted in 42 diabetic patients with chronic periodontitis. This study required a one-month treatment period. After one month, there was a significant reduction in periodontal indicators. Another study reported similar findings, where researchers used coenzyme Q10 dietary supplements to treat chronic periodontitis in type 2 diabetic patients, combined with scaling and root planing. They observed that three months after treatment, CAL, GI, and PI decreased significantly [23].

4. Conclusion

After reviewing several articles discussing, the effects of coenzyme Q10 on periodontitis, it has been demonstrated that coenzyme Q10, whether in gel form or as an oral supplement, is effective in managing periodontitis. This effectiveness is evidenced by the reduction in average clinical parameters, such as PI, BI, GI, PD, and CAL, after one week up to a maximum of three months of treatment. Coenzyme Q10 works more effectively when its application is combined with scaling and root planing (SRP). As an antioxidant, coenzyme Q10 has been proven to be highly effective in treating both general and chronic periodontitis. Moreover, coenzyme Q10 also performs well and effectively across various patient conditions.

Compliance with ethical standards

Acknowledgement

The researcher would like to express his gratitude to all parties who have been involved and helped in the preparation of this article review.

Conflict of interest

The authors declare no conflict of interest.

References

[1] Prakash S, Sunitha J, Hans M. Role of coenzyme Q10 as an antioxidant and bioenergizer in periodontal diseases. Indian J Pharmacol. 2010;42(6):334-7.

[2] Rasoolzadeh EA, Shidfar F, Rasoolzadeh RA, Hezaveh ZS. The effect of coenzyme Q10 on periodontitis: a systematic review and meta-analysis of clinical trials. J Evid Based Dent Pract. 2022;22(2):101710.

[3] Dahiya P, Kamal R, Gupta R, Bhardwaj R, Chaudhary K, Kaur S. Reactive oxygen species in periodontitis. J Indian Soc Periodontol. 2013;17(4):411-6.

[4] Chandra RV, Srinivas G, Reddy AA, et al. Locally delivered antioxidant gel as an adjunct to nonsurgical therapy improves measures of oxidative stress and periodontal disease. J Periodontal Implant Sci. 2013;43(3):121-9.

[5] Hans M, Prakash S, Gupta S. Clinical evaluation of topical application of Perio-Q gel (coenzyme Q10) in chronic periodontitis patients. J Indian Soc Periodontol. 2012;16(2):193-9.

[6] Soni S, Agrawal PK, Sharma N, Chander S. Coenzyme Q10 and periodontal health: a review. Int J Oral Maxillofac Pathol. 2012;3(2):21-6.

[7] Littarru GP, Tiano L. Bioenergetics and antioxidant properties of coenzyme Q10: recent developments. Mol Biotechnol. 2007;37(1):31-7.

[8] Pepping J. Alternative therapies: coenzyme Q10. Am J Health Syst Pharm. 1999;56(6):519-21.

[9] Al-Hasso S. Coenzyme Q10: a review. Hosp Pharm. 2000;35(1):51-5.

[10] Kwon T, Lamster IB, Levin L. Current concepts in the management of periodontitis. Int Dent J. 2021;71(6):462-76.

[11] Armitage GC, Cullinan MP. Comparison of the clinical features of chronic and aggressive periodontitis. Periodontol 2000. 2010;53(1):12-27.

[12] Albandar JM. Aggressive periodontitis: case definition and diagnostic criteria. Periodontol 2000. 2014;65(1):13-26.

[13] Loesche WJ, Grossman NS. Periodontal disease as a specific, albeit chronic, infection: diagnosis and treatment. Clin Microbiol Rev. 2001;14(4):727-52.

[14] Socransky SS, Haffajee AD, Smith C, Dibart S. Relation of counts of microbial species to clinical status at the sampled site. J Clin Periodontol. 1991;18(10):766-75.

[15] Baer PN. The case for periodontitis as a clinical entity. J Periodontol. 1971;42(8):516-20.

[16] Halliwell B, Gutteridge JM. Free radicals in biology and medicine. Oxford: Oxford University Press; 2007.

[17] Aldred S, Sozzi T, Mudway I, et al. Alpha tocopherol supplementation elevates plasma apolipoprotein A1 isoforms in normal healthy subjects. Proteomics. 2006;6(5):1695-703.

[18] Azzi A, Davies KJ, Kelly F. Free radical biology – terminology and critical thinking. FEBS Lett. 2004;558(1-3):3-6.

[19] Chapple IL, Matthews JB. The role of reactive oxygen and antioxidant species in periodontal tissue destruction. Periodontol 2000. 2007;43(1):160-232.

[20] Wang Y, Hekimi S. Understanding ubiquinone. Trends Cell Biol. 2016;26(5):367-78.

[21] Henriques BJ, Olsen KJ, Gomes CM, Bross P. Electron transfer flavoprotein and its role in mitochondrial energy metabolism in health and disease. Gene. 2021; 776:145407.

[22] Garrido-Maraver J, Cordero MD, Oropesa-Avila M, et al. Clinical applications of coenzyme Q10. Front Biosci. 2014; 19:619-33.

[23] Ghasemi S, Torab Z, Shirmohammadi A, et al. Evaluation of the effect of coenzyme Q10 supplementation along with scaling and root planing (SRP) on periodontal and gingival indices in controlled diabetic patients. J Adv Periodontol Implant Dent. 2022;14(1):32-7.

[24] Raut CP, Sethi KS, Kohale B, Mamajiwala A, Warang A. Subgingivally delivered coenzyme Q10 in the treatment of chronic periodontitis among smokers: a randomized, controlled clinical study. J Oral Biol Craniofac Res. 2019;9(2):204-8.

[25] Barakat AK, Attia A. Clinical evaluation of co-enzyme Q10 in management of chronic periodontitis patients: mouth split study. Int J Health Sci Res. 2019;9(1):69-74.

[26] Manthena S, Ramoji Rao MV, Penubolu LP, Putcha M, Sri Harsha AVN. Effectiveness of coenzyme Q10 oral supplements as an adjunct to scaling and root planing in improving periodontal health. J Clin Diagn Res. 2015;9(8): ZC26-ZC28.