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Effectiveness of Vitamin C Supplementation in Periodontal Therapy

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ABSTRACT
Periodontal disease is a chronic inflammatory condition initiated by microbial dysbiosis and driven by host immune responses, notably the overproduction of reactive oxygen species (ROS), which contribute to tissue damage. Vitamin C (ascorbic acid), a potent antioxidant, plays a role in collagen synthesis and immune regulation. Several studies have proposed vitamin C as an adjunct in periodontal therapy, yet its effectiveness remains unclear. This systematic review aims to evaluate the effect of vitamin C supplementation on clinical periodontal parameters in patients with periodontal disease. A comprehensive literature search was conducted in PubMed and Scopus for randomized controlled trials (RCTs) published between January 2015 and June 2025. Included studies investigated vitamin C supplementation in patients with periodontal disease without systemic conditions, pregnancy, lactation, or medication use. Studies involving vitamin C in combination with other nutrients without a separate vitamin C-only group were excluded. Data extraction and analysis followed the PRISMA guidelines. Four RCTs met the inclusion criteria. Significant clinical improvements were observed in periodontal parameters following non-surgical periodontal therapy (NSPT). However, the addition of vitamin C supplementation alone did not consistently provide significant improvements beyond NSPT alone. One study showed greater improvements when vitamin C was combined with melatonin, and another suggested potential benefits from guava—a natural source of vitamin C and polyphenols—over synthetic vitamin C. Current evidence suggests that while vitamin C supplementation may offer modest anti-inflammatory and antioxidant benefits, it does not consistently enhance clinical outcomes in periodontal therapy when used alone.

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INTRODUCTION

Periodontal disease is an inflammatory condition initiated by bacterial infection resulting from plaque accumulation, affecting the supporting structures of the teeth, including the gingiva, periodontal ligament, cementum, and alveolar bone [1, 2]. It is one of the most prevalent oral health problems affecting 20-50% population worldwide [3, 4]. Periodontal disease arises from a disruption in the balance of the oral microbiome that alters the normal bacterial composition [2]. Its development is driven by intricate interactions between dental biofilms and the host's immune system, which ultimately result in the breakdown of periodontal

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tissues and bone loss [5]. The condition often progresses in cycles of flare-ups and remission, and without proper treatment, it can lead to tooth displacement, increased mobility, and eventual tooth loss [2]. As the primary cause of tooth loss in adults, advanced periodontitis not only compromises chewing function but is also linked to a range of systemic diseases [6].

Polymorphonuclear leukocytes play a critical role in the body's defense against periodontal pathogens by initiating antimicrobial responses, primarily through the production of reactive oxygen species (ROS) [7]. While ROS are essential for normal immune and cellular functions at low concentrations, excessive ROS production leads to oxidative stress, contributing significantly to the destruction of periodontal tissues [8, 9]. Elevated levels of oxidative stress biomarkers are commonly observed in patients with periodontitis, indicating the central role of ROS in disease progression [10, 11].

The body's antioxidant defense mechanisms, including dietary antioxidants like vitamin C (ascorbic acid), are crucial in neutralizing excess ROS and protecting against tissue damage [12]. Vitamin C supports collagen synthesis and maintains the structural integrity of connective tissues [13]. Several studies found that its deficiency is associated with periodontal diseases [14-16]. Studies have demonstrated supplementation can improve clinical outcomes in periodontitis, making it a valuable adjunct in periodontal therapy [15, 17].

This article aims to explore the effect of vitamin C supplementation in patients with periodontal disease, evaluating whether it contributes to clinical improvement in periodontal parameters. By synthesizing available evidence from interventional studies, this review seeks to clarify the potential role of vitamin C as an adjunct in the management of periodontal disease.

METHOD

A literature search was performed using multiple electronic databases, including PubMed and Scopus, to identify relevant studies published between January 2015 and June 2025. The search strategy incorporated a combination of keywords such as "vitamin C," "ascorbic acid," "periodontal disease," "gingivitis," and "periodontitis." This review focused on studies examining the effects of vitamin C supplementation in patients with periodontal disease who did not have systemic conditions, were not pregnant or lactating, and were not on any medications. Only randomized controlled trials (RCTs) were included. Studies were excluded if they were not peer-reviewed (e.g., editorials, commentaries, letters), unavailable in full text, did not investigate vitamin C in the form of supplementation, or assessed vitamin C in combination with other nutrients without a separate vitamin C-only group. Study selection followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The extracted data included the author(s) and year of publication, article title, sample, intervention details, and main findings. Data were tabulated and then subjected to a descriptive analysis. The data were organized in tabular format and analyzed descriptively.

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RESULTS AND DISCUSSION

As illustrated in the PRISMA flow diagram (Figure 1), a total of 1,503 records were identified through electronic database searches. After removing 115 duplicates, 580 records remained for title and abstract screening. Of these, 543 records were excluded based on irrelevance to the inclusion criteria. The full texts of 37 articles were assessed for eligibility, with 33 being excluded for reasons such as non-randomized design and lack of vitamin C as a standalone intervention. Finally, 4 randomized controlled trials met all inclusion criteria and were included in the final qualitative synthesis.

All studies consistently reported clinical improvements in periodontal parameters following non-surgical periodontal therapy (NSPT), regardless of whether vitamin C supplementation was provided. In the study by Nisha et al. (2023), both groups receiving NSPT (with or without vitamin C) demonstrated significant clinical improvement; however, vitamin C supplementation (500 mg/day for 3 months) did not yield any additional benefit in either total antioxidant capacity (TAOC) or clinical parameters compared to NSPT alone [18]. Similarly, Raghavendra et al. (2017) found that although vitamin C (1500 mg/day) reduced gingival bleeding index (GBI) more than NSPT alone, there were no statistically significant improvements in plaque index (PI), gingival index (GI), probing depth (PD), clinical attachment level (CAL), or salivary TAOC [19].

Amaliya et al. (2018) evaluated the effects of vitamin C (200 mg/day) and guava (rich in natural vitamin C and polyphenols) in an experimental gingivitis model [20]. Both interventions led to significantly lower gingival index scores compared to the control group, despite all groups experiencing an increase in plaque accumulation during the experimental period. Chitsazi et al. (2017) assessed vitamin C in combination with melatonin [21]. All groups showed significant improvement in PD and CAL, but the group receiving both melatonin and vitamin C demonstrated superior clinical outcomes at 6 months, suggesting a potential synergistic effect.

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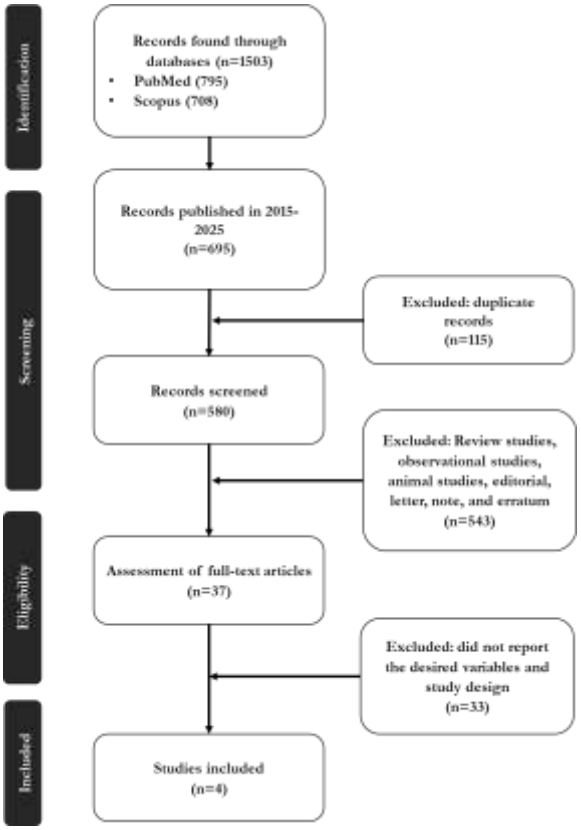

Figure 1. Study selection process using PRISMA guidelines

The findings of this review suggest that while vitamin C supplementation may contribute modest benefits in the management of periodontal inflammation, its role as a standalone adjunct to non-surgical periodontal therapy remains limited. Most studies reported improvements in clinical periodontal outcomes across all treatment groups; however, the addition of vitamin C did not consistently offer statistically significant advantages over NSPT alone. This aligns with findings from prior systematic reviews, which reported that while vitamin C may benefit gingivitis by reducing bleeding indices, it does not significantly enhance PD or CAL when added to NSPT in periodontitis patients [22].

Regarding antioxidant status, both Nisha et al. and Raghavendra et al. observed lower total antioxidant capacity (TAOC) in patients with periodontitis compared to healthy controls [18, 19]. Despite this, vitamin C supplementation did not significantly improve TAOC beyond the effects of NSPT alone. These results suggest the body's inherent antioxidant mechanisms and treatment effects may overshadow the impact of supplementation. It is also worth noting that TAOC is influenced by multiple systemic and dietary factors, which may confound the effect of isolated supplementation [23].

Table 1. Overview of the included studies

Authors	Title	Samples	Intervention	Main Findings
Nisha S et al. (2023) [18]	Effect of non-surgical periodontal	105 participants (70 with	Chronic periodontitis patients were	Chronic periodontitis patients showed

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Authors	Title	Samples	Intervention	Main Findings
	therapy and vitamin C supplementation on total antioxidant capacity in patients with chronic generalized periodontitis – A randomized controlled trial	chronic periodontitis, 35 periodontally healthy controls); Age: 35–55 years	divided into two groups: - Group I received non-surgical periodontal therapy only - Group II received non-surgical periodontal therapy combined with vitamin C (500 mg/day) for 3 months.	significantly lower serum and salivary total antioxidant capacity than healthy controls. Both group I and group II with chronic periodontitis showed clinical improvements post-treatment, but vitamin C supplementation did not provide additional benefits in terms of salivary total antioxidant capacity or clinical outcomes.
Amaliya et al. (2018) [20]	Effect of guava and vitamin C supplementation on experimental gingivitis: A randomized clinical trial	48 participants randomly assigned to three groups (16 per group); Age: 18–25 years	Group I received 200 g of guava; Group II received 200 mg of synthetic vitamin C; Group III (control) received water. After a 14-day pre-experimental oral hygiene phase, a 14-day experimental gingivitis phase began, during which participants refrained from	All groups experienced increased plaque index. However, the guava and vitamin C groups had significantly lower gingival index scores than the control group, suggesting anti-inflammatory effects.

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Authors	Title	Samples	Intervention	Main Findings
			cleaning their lower teeth.	
Chitsazi M et al. (2017) [21]	Effects of adjunctive use of melatonin and vitamin C in the treatment of chronic periodontitis: A randomized clinical trial	60 patients with chronic periodontitis randomly assigned to three groups (20 per group); Age: 23–65 years	Group I received non-surgical periodontal therapy only; Group II received non-surgical periodontal therapy + melatonin (2 mg a day for 4 weeks); Group 3 received non-surgical periodontal therapy + (2 mg a day for 4 weeks) + vitamin C (60 mg for females and 75 mg for males for 4 weeks).	All groups showed significant improvements in probing depth and clinical attachment level from baseline to 3 and 6 months. At 6 months, the group receiving melatonin + vitamin C showed significantly greater improvement than the other groups indicating an added benefit of vitamin C.
Raghavendra U et al. (2017) [19]	Vitamin C supplementation as an adjunct to nonsurgical therapy in the treatment of chronic periodontitis	100 participants (50 with chronic periodontitis and 50 healthy controls). Chronic periodontitis group was divided into group I and group II (25 each); Age: 30–60	Group I periodontal therapy only; Group II received non-surgical periodontal therapy + vitamin C (1500 mg/day).	Periodontitis patients had significantly lower salivary total antioxidant capacity than controls ($p < 0.001$). Both group I and group II showed significant clinical improvements after 1 and 2 months. Group II had a greater reduction in gingival bleeding

Authors	Title	Samples	Intervention	Main Findings
				index, but no significant additional improvements in plaque index, gingival index, pocket depth, clinical attachment level, or salivary total antioxidant capacity compared to group I.

The potential advantage of whole-food sources of antioxidants may over isolated supplementation, likely due to the synergistic effects of multiple bioactive compounds within the fruit. This is supported by broader phytotherapy research, which indicates that such compounds may enhance oral health by inhibiting plaque formation, reducing bacterial adhesion, and modulating inflammatory pathways [24] .

Furthermore, the combination of vitamin C with other nutraceuticals, such as melatonin, has led to significantly improved periodontal outcomes compared to single-agent supplementation [21]. The authors suggest this enhanced effect may result from a synergistic antioxidant role of vitamin C in recycling melatonin and sustaining its efficacy [21, 25]. These findings support developing multi-antioxidant strategies to augment periodontal therapy..

Overall, while vitamin C supplementation appears safe and may support periodontal therapy, current evidence does not strongly support its routine use as a standalone adjunct. Further studies with standardized dosages, longer durations, and larger sample sizes are needed to clarify its therapeutic role in periodontal management.

CONCLUSION

This systematic review highlights that while vitamin C supplementation may offer some benefits in reducing gingival inflammation and supporting antioxidant defense, the current evidence does not consistently support its significant added value as an adjunct to non-surgical periodontal therapy. Further well-designed, long-term randomized controlled trials with standardized dosing and outcome measures are needed to clarify the specific role and therapeutic potential of vitamin C in periodontal therapy.

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