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Evidence on the use of Propolis Gel in the Management of Periodontal Disease: A Narrative Review

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Abstract

Natural bioactive compounds have attracted increasing interest as adjuncts in periodontal therapy due to their potential to modulate inflammation and microbial activity. Among these compounds, propolis has been extensively explored because of its antioxidant, antimicrobial, and immunomodulatory effects. The development of gel-based delivery systems has further enhanced its therapeutic potential by enabling localized application and controlled release at periodontal sites. Therefore, this narrative review aimed to summarize and discuss the available scientific evidence regarding the use of propolis-based gels in the treatment of periodontal disease. A total of ten studies were selected from the literature, including in vitro and in vivo investigations (n = 7) and clinical trials (n = 3). Overall, the studies demonstrated that propolis gels exhibited favorable physicochemical properties for periodontal application and suggested potential anti-inflammatory effects. However, the antimicrobial effectiveness against *Porphyromonas gingivalis* and the reduction in probing depth in animal models presented inconsistent findings. Although clinical studies reported favorable outcomes, substantial methodological heterogeneity among them limits direct comparison and interpretation. In summary, while propolis-based gels show promise as periodontal adjuncts due to their physicochemical properties and anti-inflammatory potential, clinical evidence remains limited and inconsistent. High-quality randomized controlled trials are essential to establish standardized protocols and confirm long-term safety and efficacy.

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Abbreviations

APT	adjunctive periodontal therapy
ATP	adenosine triphosphate
CAPE	caffeic acid phenyl ester
COX	cyclooxygenase
GI	gingival inflammation
LOX	lipoxygenase
MMP	matrix metalloproteinase
NaCMC	sodium carboxymethylcellulose
NSPT	non-surgical periodontal treatment
PD	periodontal disease
PE	propolis extract
PPD	probing pocket depth
SRP	scaling and root planing

Introduction

Periodontal disease (PD) is a chronic inflammatory condition with a global prevalence of about 11%, and if left untreated, it can lead to tooth loss and significantly impair quality of life[1-3]. Among the available treatment options, non-surgical periodontal treatment (NSPT) - based on the mechanical removal of biofilm and calculus, combined with risk factor control and improved oral hygiene - is considered the gold standard. However, its effectiveness is limited in anatomically challenging sites and in patients with systemic conditions that compromise the host response[2-4]. In this context, adjunctive periodontal therapy (APT) has gained importance for enhancing NSPT outcomes and reducing the need for surgical interventions. Strategies include host modulation, systemic antibiotics, and local approaches such as laser therapy, probiotics, chlorhexidine, and natural products. Locally delivered adjuncts are particularly advantageous due to their targeted delivery and reduced side effects. Innovative drug delivery systems - such as gels, chips, or fibers - are being explored to release active compounds and stabilize the blood clot, underscoring the importance of new treatment options for optimizing PD management[3-5]. Among local drug delivery systems, gels stand out as versatile vehicles for periodontal therapy. Gel formulations are three-dimensional networks with bonds between polymeric chains that occur when liquid settles to form a semi-solid. In hydrogels, these polymers are hydrophilic[6]. Thus, smart hydrogels can change their characteristics based on the microenvironment, such as thermoresponsive hydrogels that undergo sol–gel transition with temperature change, and in situ gels that change their physicochemical characteristics at the target site. These approaches appear to be promising forms of administration, since their formulations can be tailored through rheological properties to achieve the desired injectability[5-7].

A wide range of natural and synthetic materials has been explored for gel formulation, offering additional antimicrobial and anti-inflammatory properties. Among them, propolis stands out as a resinous natural substance produced by bees *(Apis mellifera)* in combination with plant exudates. Its composition varies according to its geographic location and botanical origin. Flavonoids, phenolic acids, waxes, aromatic oils, and pollen are part of its composition[4,8]. Research indicates that propolis exhibits anti-inflammatory, antimicrobial, and immunomodulatory properties. Propolis helps in the modulation of the immune response by reducing inflammatory cytokines such as interleukin (IL) - IL-1α, IL-1β, IL-4, IL-6, IL-12p40, and IL-12p70, and by increasing serum levels of immunoglobulins like IgA and IgG[9]. In addition, this substance has been shown to reduce the expression of inflammation-related genes such as MMP-7 and Wnt2b. Moreover, caffeic acid phenyl ester (CAPE) present in propolis may inhibit cyclooxygenase (COX) and lipoxygenase (LOX) activity, reducing prostaglandins and leukotrienes4. Its antimicrobial effect involves mechanisms such as increasing cell permeability, inhibiting adenosine triphosphate (ATP) production, and interacting with microbial DNA[10]. It is effective against periodontopathogens such

as *Porphyromonas gingivalis, Aggregatibacter actinomycetemcomitans,and Prevotella intermedia.* Artepillin C has demonstrated bacteriostatic activity against *P. gingivalis*[4]. In addition, chrysin and quercetin are flavonoids that have shown effectiveness against alveolar bone resorption, making them useful in the treatment of periodontitis and gingivitis[11]. Thus, the effects of propolis in the treatment of periodontal disease have been investigated. A systematic review evaluated different propolis administration protocols, including hydroalcoholic solution, and the results demonstrated improvements in periodontal clinical parameters compared to scaling and root planing therapy or placebo[12]. In this context, the review of strategies for administering propolis specifically incorporated into the form of hydrogels, gels, or thermosensitive hydrogels in the management of periodontitis remains largely unexplored. Therefore, this narrative review aims to clarify the current evidence on propolis-based gels or hydrogels in the context of periodontal diseases, based on in vitro, in vivo, and clinical studies.

Materials and Methods

Study Design

This narrative review aims to assess the evidence on the effects of propolis gels in the context of periodontal therapy. Accordingly, the review was structured to address the following question: "What evidence is available regarding the use of propolis gel in the treatment of periodontal disease?"

Search Strategy

The literature search was conducted on August 25, 2025, in the Embase, LILACS, Scopus, MEDLINE (PubMed), Web of Science, and SciELO databases. Combinations of descriptors related to propolis (propolis, Brazilian green propolis), delivery systems (hydrogel, gel, thermosensitive, temperature-sensitive, thermoresponsive, mucoadhesive), and periodontal conditions (periodontitis, periodontal disease, periodontal diseases, gingivitis) were used, combined with the Boolean operators AND and OR. No restrictions regarding publication period were applied (Table 1).

Inclusion Criteria

The inclusion criteria were defined to select studies that evaluated the use of propolis in gel formulations, including thermosensitive and in situ gels (for the treatment of periodontitis and gingivitis). In vitro studies were included when they involved characteristics relevant to periodontal administration of the gel or periodontal cells/microorganisms. In vivo and clinical studies were also considered, provided they presented outcomes that allowed the evaluation of the effects of propolis on periodontal parameters.

Exclusion Criteria

The exclusion criteria included studies conducted in the context of diseases other than periodontitis and gingivitis, such as mucositis, peri-implantitis, and other pathologies of the maxillomandibular complex.Studies employing alternative forms of propolis administration, such as pure extract or gels containing other natural active ingredients, as well as studies in which propolis was used exclusively in combination with other adjunctive therapies or active compounds, were also excluded.

Table 1: Search strategy

Database	Search strategy	Identified records	Date
Embase	(propolis'/exp OR 'propolis':ab,ti OR 'brazilian green propolis':ab,ti) AND ('hydrogel'/exp OR 'hydrogel':ab,ti OR gel:ab,ti OR 'thermosensitive':ab,ti OR 'temperature-sensitive':ab,ti OR 'thermoresponsive':ab,ti OR 'mucoadh--esive':ab,ti) AND ('periodontitis'/exp OR 'periodontal disease'/exp OR 'periodontitis': ab,ti OR 'periodontal disease':ab,ti OR	22	August 25, 2025

	'periodontal diseases':ab,ti OR 'gingivitis': ab,ti) AND [embase]/lim		
LILACS	(((propolis) AND (hydrogel OR gel OR termossensível OR thermosensitive OR temperature-sensitive OR thermoresponsive OR mucoadhesive))) AND (((periodontitis OR periodontal disease OR gengivitis))) AND db:("LILACS") AND instance:"lilacsplus"	7	August 25, 2025
Scopus	(TITLE-ABS-KEY((propolis OR "Brazilian green propolis") AND (hydrogel OR gel OR thermosensitive OR "temperature-sensitive" OR thermoresponsive OR mucoadhesive)) AND TITLE-ABS-KEY(periodontitis OR "periodontal disease" OR "periodontal diseases" OR gingivitis))	30	August 25, 2025
MEDLINE (PubMed)	(("Propolis"[MeSH Terms] OR "Propolis"[Title/Abstract] OR "Brazilian green propolis"[Title/Abstract]) AND ("Hydrogels"[MeSH Terms] OR "hydrogel"[Title/Abstract] OR "gel" [Title/Abstract] OR "thermosensitive "[Title/Abstract] OR "temperature-sensitive" [Title/Abstract] OR "thermoresponsive" [Title/Abstract] OR "mucoadhesive"[Title/Abstract]) AND ("Periodontitis"[MeSH Terms] OR "Periodontal Diseases"[MeSH Terms] OR "Gingivitis"[MeSH Terms] OR "Periodontitis" [Title/Abstract] OR "periodontal disease" [Title/Abstract] OR "Periodontal Diseases" [Title/Abstract] OR "Gingivitis"[Title/Abstract]))	17	August 25, 2025
Web of Science	("propolis" OR "Brazilian green propolis") AND ("hydrogel" OR "gel" OR "thermosensitive" OR "temperature-sensitive" OR thermoresponsive OR mucoadhesive*) AND ("periodontitis" OR "periodontal disease" OR "gingivitis") (All Fields)	29	August 25, 2025

Results

The studies selected from the databases were imported into the Rayyan manager, where 98 records were initially identified, and 56 remained after duplicate removal. A reviewer selected the studies by reading the titles and abstracts. When uncertainty arose regarding eligibility based on title and abstract, the full text was retrieved for further evaluation. In addition, all studies that appeared potentially eligible based on the abstracts were also assessed in full text. In total, 22 articles were evaluated in full; however, 1 article could not be retrieved. Ultimately, 10 studies were included, and 46 were excluded, as illustrated in Figure 1, adapted from PRISMA 2020 flow diagram (Figure 1)[13].

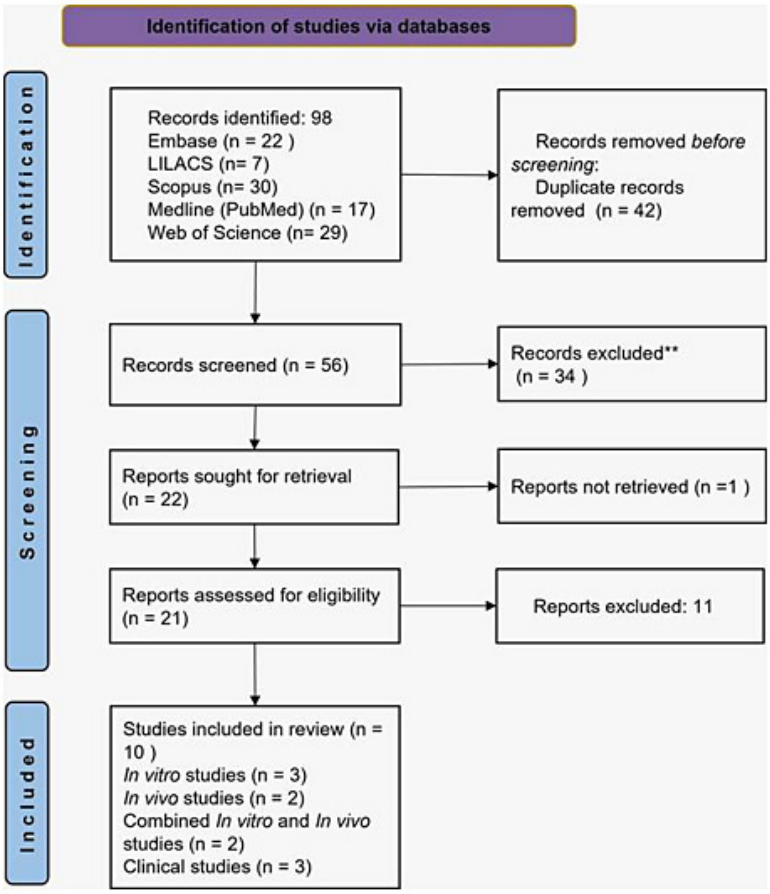

Fig. 1: Flow diagram of the study selection process, adapted from the PRISMA flow diagram.

The formulations identified in the included studies comprised:

- A thermosensitive cubic liquid crystal hydrogel containing phytosterol triol, total flavonoid extract of propolis, and carbitol[11];
- Semisolid systems composed of poloxamer 407, carbopol, and 4% propolis extract (PE)[14];
- A gel containing 35% propolis and dimethyl sulfoxide[15];
- A gel formulated with Carbopol 940, sodium carboxymethylcellulose (NaCMC) and 10% PE[16].

Formulations prepared with stingless bee propolis extract (50%, 60% and 70%), distilled water, triethanolamine, and carbopol[17]. Another study used a similar composition consisting of propolis extract (at concentrations of 50%, 60%, and 70%), distilled water, triethanolamine, and carbopol[18]. The composition of the propolis gel was not reported in some studies[19-22].

In Vitro Studies

Several in vitro studies have investigated the characteristics of gels intended for periodontal application[11,14-17]. Rheological analyses showed that the gels exhibited pseudoplastic behavior. In addition, satisfactory viscosity and injectability were reported[11,14-16]. The release of propolis components from the polymer matrix was confirmed in multiple studies[11,14,16]. All studies reported sustained drug release, with some formulations maintaining drug delivery for more than seven days[14,16]

Additionally,mucoadhesion was satisfactory for periodontal administration[14-16]. Increasing concentrations of propolis extract resulted

in reduced gel mucoadhesion, although adhesion remained favorable under periodontal pocket temperature conditions[14].

The antimicrobial effectiveness of propolis gels varied. Microorganisms were tested according to the propolis concentration. Higher concentrations were more effective[17]. However, the antimicrobial activity of propolis-based gels against *P. gingivalis* has been controversial. While one study showed that propolis gel was not effective against *P. gingivalis*[16], another study demonstrated inhibitory activity against this microorganism. Furthermore, the 70% propolis extract exhibited greater antimicrobial efficacy against *P. gingivalis* than 0.2% chlorhexidine[17].

In Vivo Studies

In vivo studies evaluating periodontal parameters reported heterogeneous findings. A thermosensitive hydrogel containing propolis flavonoids decreased the infiltration of inflammatory cells, preserved gingival tissue architecture, and led to a decrease in probing pocket depth (PPD)[11]. In another study, an increased number of fibroblasts, particularly in the group treated with 70% propolis gel, and a decrease in the number of neutrophils were reported[18]. In contrast, Soekanto *et al*., 2021; did not detect significant differences in PPD or alveolar bone loss between animals treated with 5% and 10% propolis gels and the placebo group, which may reflect methodological differences and the short follow-up period[19]. Propolis gels were also shown to decrease pro-inflammatory cytokine IL-1 and matrix metalloproteinases such as MMP-2, MMP-8, and MMP-9. In addition, they exhibited anti-inflammatory effects through the inhibition of TLR4/MyD88/NF-κB p65 pathway[11,17].

Clinical Studies

The efficacy of propolis gels in the treatment of periodontitis and gingivitis was evaluated in three clinical studies[20-22], two of which were randomized clinical trials[20-21]. None of these studies reported the composition of the propolis hydrogel. Propolis gels have been used both as adjuvants to scaling and root planing (SRP)[20] or as components of dental formulations intended for brushing[21-22].

Table 2: Propolis gel formulations, administration protocols, and main clinical findings of the included studies

Citation	Type of study	Composition	Form of administration	Conclusion
Bruschi et al., 2007[14]	In vitro	Semisolid systems with poloxamer 407, carbopol, and propolis extract 4%	Not reported	Suitable rheological, mechanical, and mucoadhesive properties for periodontal application.
Aslani et al., 2016[16]	In vitro	Carbopol 940, (NaCMC), and propolis extract 10%	Not reported	Demonstrated adequate viscosity and mucoadhesive properties, along with an optimal propolis release profile.
Khaing et al., 2021[15]	In vitro	Propolis 35 % and dimethyl sulfoxide	Not reported	The in situ forming gel of propolis demonstrated good release and showed an inhibitory effect agains three microorganisms *(Staphylococcus aureus, Candida albicans, and Streptococcus mutans),*but no activity against *P. gingivalis* and *Escherichia coli*.

Soekanto et al., 2021[19]	In vivo	Not reported	Subgingival administration	The 5% and 10% propolis gels exhibited no significant therapeutic effect on periodontitis in a Mus musculus experimental model.
Maharani et al., 2024[18]	In vivo	Propolis extract (50%, 60%, and 70%),distilled water, triethanolamine and carbopol	Subgingival administration + SRP	The 70% propolis extract gel showed the highest effectiveness in accelerating periodontal healing, suggesting its potential as an adjunctive therapy for periodontitis.
Tang et al., 2024[11]	In vitro and in vivo	Cubic liquid crystal hydrogel with phytosterol triol, total flavonoid extract of propolis and carbitol	Subgingival administration	Thermosensitive cubic liquid crystal hydrogel deposition achieved multiple periodontal protection, reducing the level of periodontal inflammation, promoting osteogenic differentiation, and periodontal tissue regeneration.
Wulandari et al., 2024[17]	In vitro and in vivo	Extract of stingless bee propolis (50%, 60% and 70%), distilled water, triethanolamine and carbopol	Subgingival administration	Propolis is a substance that can be used as an adjunctive therapy for periodontitis, helping to reduce inflammation and promote the healing process.
Tanasiewicz et al., 2012[22]	Clinical study	Not reported	Dental formulations for brushing	Propolis gel showed an anti-inflammatory effect on the gingival tissues.
Kumar et al., 2015[21]	Clinical study	Not reported	SRP + Dental formulations for brushing	Propolis gel led to a decrease in red complex microorganisms and a reduction in clinical parameters (PI,GI, Bleeding on Probing, PPD, and CAL).
Aggarwal et al., 2023[20]	Clinical study	Not reported	Subgingival administration + SRP	Propolis gel + SRP demonstrated favorable clinical changes within the group itself, but without significant differences compared to conventional treatment (SRP).

The group treated with propolis gel as an adjunct to root planing showed a statistically significant reduction in gingival inflammation (GI). A significant decrease in PI, PPD, and clinical attachment level (CAL) was observed at both 1 and 3 months in all groups. However, the adjunctive use of propolis gel did not result in statistically significant differences when compared with the SRP-only group[20]. The use of propolis gel in dental formulations for brushing improved the results of PI, GI, PPD, and CAL in patients with periodontitis[21]. In addition, the bleeding index was lower in the group that used propolis gel in brushing formulations, suggesting a beneficial effect in cases of gingivitis[21-22].

Discussion

Recently, there has been an increasing interest in natural products. Propolis has been studied as an adjunct to periodontal treatment due to its anti-inflammatory, antimicrobial, antioxidant, and immunomodulatory properties. Its incorporation into gel formulations has gained relevance, as these systems allow site-specific action, uniform distribution, and sustained release of the active ingredient[23-24].

Physicochemical and Rheological Properties

The study of rheological properties is essential for gel formulations, since characteristics such as spreadability, syringability, and texture determine their clinical applicability[25]. The in vitro studies included in this review showed that propolis gels exhibited adequate viscosity and injectability, as well as mucoadhesion properties and controlled release of the active ingredient[11, 14-17]. However, heterogeneity in composition was observed, a factor that directly impacts physicochemical properties. Carbopol was the most frequently used polymer[14], [16-18], and higher concentrations were associated with greater hardness, compressibility, and mucoadhesion, but with reduced drug release, findings consistent with Alfaris *et al*., 2022;[26]. Similarly, the literature describes that higher concentrations of poloxamer are also related to increased mucoadhesion[27].

In addition to the basic elements required for gel formulation, the incorporation of propolis also influenced the physicochemical properties of the gels, particularly mucoadhesion. Mucoadhesion refers to the ability of a formulation to adhere to the mucosal epithelium and for maintaining the product at the target site[28]. Its occurrence depends on the expansion of polymer chains, with the formation of hydrogen bonds between the hydrophilic groups of the polymer and the mucin present in the mucosa[16]. In this context, one study reported that increasing propolis concentrations reduced mucoadhesive strength[14], contrary to the findings of Khaing *et al*., 2021, who found an increase in mucoadhesion with the incorporation of propolis, in agreement with Berreta *et al*., 2013[15,25]. These authors demonstrated that propolis incorporation increased mucoadhesion in carbopol and poloxamer gels, whereas no significant effect was observed in alginate and chitosan-based hydrogels[25]. Propolis also increased gel viscosity[15], corroborating previous findings[29], and modified the pseudoplastic profile in chitosan and poloxamer gels, but not carbopol formulations.[25] Therefore, these results indicate that the influence of propolis incorporation on mucoadhesion and rheological properties may vary according to the polymers used in the formulation of the gels and the concentration of propolis.

Gels for periodontal administration should provide controlled and sustained drug release. For greater reliability, the evaluation of propolis component release should be performed under conditions that simulate the periodontal environment (temperature, pH, presence of gingival crevicular fluid)[14]. Despite methodological heterogeneity, all studies consistently demonstrated effective release of propolis components from the polymer matrix, supporting the feasibility of these systems for controlled periodontal delivery[11,14-16]. Regarding the pH of propolis gels, values ranged between 5 and 6, whereas the pH of propolis extract itself was slightly higher, between 6 and 7. The pH values of the propolis gels were considered adequate for periodontal administration, as they did not cause irritation and were close to the ideal pH of the periodontal pocket, approximately 6.2[16].

In Vitro Antimicrobial Activity

The antimicrobial activity of propolis gels varied across studies. Formulations at 35% were effective against *S. aureus, C. albicans, and S. mutans,* but not against *P. gingivalis,* while in other studies propolis in concentrations of 10% and 70% demonstrated

activity against this periodontal pathogen[16-17]. Agarwal *et al*., 2012; reinforce the potential of chinese propolis by demonstrating activity against *P. gingivalis* and *A. actinomycetemcomitans*[30]. These differences may be attributed to variations in the chemical composition and concentration of bioactive compounds among different types of propolis that may influence antimicrobial efficacy. This suggests that propolis may exhibit in vitro antimicrobial activity against periodontal pathogens, depending on its composition and concentration. Therefore, it could be considered a potential natural adjunct to periodontal therapy. This approach may contribute to reducing reliance on antibiotics and chlorhexidine, whose antimicrobial efficacy is well established but accompanied by cytotoxicity, even in gel formulations[5,30]. Nevertheless, concentrations of propolis extract that are effective against periodontal pathogens have also been associated with cytotoxicity in gingival fibroblasts, in an apparently dose-dependent manner[31-32]. It is important to highlight that the cytotoxicity of propolis gels was not evaluated in the studies included in this review, representing a gap that should be addressed in future investigations.

Anti-Inflammatory, Immunomodulatory, and Regenerative Effects

Studies have shown that propolis reduces the release of pro-inflammatory cytokines, the transcription factor NF-κB, and NLRP inflammasomes, in addition to suppressing signaling pathways associated with the inflammatory response[33]. Similarly, propolis gels have demonstrated relevant anti-inflammatory and regenerative effects in in vivo models. In these investigations, hydrogels were able to reduce the number of inflammatory cells and IL-1β levels, and suppressed the expression of TLR4 (Toll-like receptors)/MyD88/NF-κB p65, an innate immunity signaling pathway involved in the activation of pro-inflammatory mediators and the induction of apoptosis. A decrease in reactive oxygen species was also observed in animals treated with propolis hydrogel, further reinforcing its antioxidant properties[11].

The reduction in the expression of matrix metallo-proteinases (MMPs), including MMP-2 and MMP-9, RANKL, and the number of osteoclasts, factors associated with collagen degradation and bone resorption, combined with an increase in RUNX-2 and ALP, proteins associated with osteoblastic activity, demonstrates the protective potential of propolis gels on periodontal tissues. This effect was confirmed by microtomography in the study by Tang *et al*. 2024, which also attributed regenerative properties in the periodontium in vivo to propolis flavonoid gel[11]. Other studies have associated propolis with increased collagen deposition, enhanced angiogenesis, re-epithelialization, and reduced fibrosis, results achieved through decreased release of histamine and pro-inflammatory cytokines, as well as a reduction in the number of mast cells[33]. However, these findings are derived from animal models, and direct extrapolation to clinical periodontal therapy should be interpreted with caution.

Therapeutic Effects on Periodontal Parameters in Animal Models

Regarding PPD in vivo, Tang *et al*., 2024 reported a reduction in this parameter in the groups treated with the hydrogel containing propolis flavonoids[11]. Although in vivo studies highlight the therapeutic potential of propolis in the treatment of periodontal disease, there are still inconsistent results. Soekanto *et al*., 2021; reported that 5% and 10% propolis gels did not have a significant therapeutic effect in the treatment of periodontitis, as no differences in PPD or alveolar bone loss were observed between the propolis-treated groups and the control group[19]. However, it is important to note that the study had a short duration, lasting only 14 days, which may have limited the extent of bone loss observed. In addition, this parameter was evaluated in a restricted manner, as bone loss was quantified in only two dimensions. It should also be considered that the authors did not perform mechanical therapy to control periodontal disease, a factor that may have further limited the observed therapeutic effects. However, Tang *et al*., 2024; did not use scaling and root planing and were still able to demonstrate favorable results with the application of propolis gel, suggesting that the absence of conventional therapy is not the only determining factor[11]. Furthermore, these differences may be related both to the different animal species used—such as Wistar rats, Sprague-Dawley rats, and Mus musculus mice—and

to the different experimental models employed to induce periodontitis. It is known that the response to the periodontal inflammatory process may vary according to the animal strain and the method used to induce the disease, whether by ligature alone or in association with *P. gingivalis* inoculation. In this context, pathogen inoculation has been described as a factor that exacerbates periodontal destruction, intensifying inflammatory responses and accelerating tissue breakdown[34].

Therapeutic Effects on Periodontal Parameters in Clinical Studies

In the clinical studies evaluated, improvements in periodontal parameters associated with the use of propolis were observed, either as an adjunct gel to scaling and root planing or as a gel applied during brushing after SRP. Regarding PPD and CAL, two studies reported clinically favorable reductions; however, in the trial that investigated propolis gel in combination with conventional mechanical therapy, these improvements did not differ statistically from those achieved with basic periodontal treatment alone, suggesting no additional benefit from combining adjunctive therapy[20]. It is important to consider that the intragroup improvements observed in the clinical parameters may be primarily attributed to periodontal instrumentation rather than to the effect of the propolis gel itself. On the other hand, the study that evaluated the gel applied during toothbrushing demonstrated significant improvements in these same outcomes, suggesting a potential contribution of propolis when incorporated into the daily oral hygiene routine[21-22]. However, it should be noted that, in one of the studies, the use of brushing gels was combined with scaling and root planing, which may also have influenced the results[21].

Regarding inflammatory outcomes, two studies that used propolis gel for brushing reported reduced gingival bleeding and improvements in gingivitis, reinforcing the anti-inflammatory potential of the substance[21-22]. In the study by Tanasiewicz *et al*., 2012, this parameter was significant only in the group that exhibited adequate oral hygiene, with no alterations in the marginal periodontium[22]. However, although the adjunctive gel group showed intragroup improvements in GI and PI after SRP, these changes were not statistically different from those observed in the control group, indicating no additional benefit of propolis beyond mechanical therapy alone[20].

Overall Considerations, Limitations, and Future Perspectives

It is important to consider that the composition of propolis may vary according to its botanical origin and geographical location, which directly influences its bioactivity profile[30]. Moreover, differences in the concentrations used and heterogeneity in gel formulations across studies may explain some of the discrepancies observed in the results. It should be noted, however, that none of the clinical studies reviewed provided a detailed description of the composition of the propolis gel used, which limits reproducibility and hinders the identification of the components responsible for the observed effects. In addition, the samples were small and follow-up periods were short, factors that restrict the generalization of the findings. Taken together, the available evidence supports the beneficial effects of propolis in the control of periodontal diseases, but also reinforces the need for clinical trials with larger sample sizes, standardized formulation descriptions, and long-term follow-up to confirm its efficacy and safety. The clinical studies evaluated suggest that gels containing propolis have therapeutic potential in controlling periodontal clinical parameters; however, these effects should be interpreted with caution, as the studies employed different methodologies and present several limitations.

Conclusion

The findings indicate that the propolis gels exhibit physical properties suitable for periodontal disease management, including appropriate viscosity, injectability, mucoadhesion, and sustained release profile. In vivo findings suggest a promising adjunctive role in the management of periodontitis and gingivitis. However, additional clinical trials are needed to confirm their efficacy and safety in the treatment of periodontal diseases.

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Conflict of Interest
The authors do not have any conflict of interest.

Data Availability Statement
This statement does not apply to this article.

Ethics Statement
This research did not involve human participants, animal subjects, or any material that requires ethical approval.

Informed Consent Statement
This study did not involve human participants, and therefore, informed consent was not required.

Clinical Trial Registration
This research does not involve any clinical trials.

Permission to reproduce material from other sources
Not Applicable.

Author Contributions
- **Ana Carolina Duarte Firmino:** Conceptualization, Literature Search, Article Selection, Data Extraction, Writing – Original Draft.
- **Nathalya Maria Vileila Moura:** Writing – Review & Editing.
- **Mario Taba Jr:** Writing – Review & Editing, Supervision.

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