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Review Article

Formulation, Development, and Evaluation of a Dental Gel Containing Clove (*Syzygium Aromaticum*) for the Treatment of Periodontitis: A Review

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ABSTRACT

Periodontitis is a chronic inflammatory disease affecting the supporting structures of teeth. Conventional treatment includes mechanical debridement and adjunctive antimicrobial therapy. This study aimed to formulate and evaluate a herbal dental gel containing clove (*Syzygium aromaticum*), known for its antimicrobial and anti-inflammatory properties, as an alternative or adjunctive therapy for periodontitis.

INTRODUCTION

Periodontitis is a common oral disease characterized by inflammation and destruction of the periodontium. The condition, if untreated, can lead to tooth loss. Traditional therapies have limitations including patient compliance, microbial resistance, and adverse effects. Herbal formulations offer a promising alternative due to their natural origin, lower side effects, and multifunctional benefits. Clove, derived from the flower buds of *Syzygium aromaticum*, possesses eugenol, a compound with proven antimicrobial, analgesic, and anti-inflammatory effects. This

study focuses on developing a clove-based dental gel and evaluating its physicochemical properties and therapeutic potential against periodontitis.

2. MATERIALS AND METHODS

2.1 MATERIALS

- Clove essential oil (rich in eugenol)
- Carbopol 934 (gelling agent)
- Glycerin (humectant)
- Propylene glycol (co-solvent)
- Triethanolamine (neutralizing agent)
- Methylparaben (preservative)
- Distilled water

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2.2 Formulation of Dental Gel

The gel was formulated by dispersing Carbopol 934 in distilled water with continuous stirring. Glycerin and propylene glycol were added as moisturizers. Clove oil was incorporated with gentle mixing. The pH was adjusted using triethanolamine. The final gel was stored in airtight containers.

Ingredient	Quantity (%)
Clove Oil	1.0
Carbopol 934	1.0
Glycerin	5.0
Propylene Glycol	10.0
Methylparaben	0.2
Triethanolamine	q.s. (to pH 6.8–7)
Distilled Water	q.s. to 100

2.3 Evaluation Parameters

- Physical appearance (color, homogeneity)
- pH determination (digital pH meter)
- Viscosity (Brookfield viscometer)
- Spreadability
- Drug content uniformity
- Antimicrobial activity (agar diffusion against *Porphyromonas gingivalis*, *Fusobacterium nucleatum*)
- Stability studies (temperature and humidity variations)
- In vitro release study (dialysis membrane method)

3. RESULTS AND DISCUSSION

3.1 Physical Characteristics

The prepared gel was light brown, homogeneous, with no phase separation, and had a pleasant clove odor.

3.2 pH and Viscosity

The gel exhibited a pH of 6.9 ± 0.1 , ideal for oral application. Viscosity was found to be 28,000–30,000 cps, indicating suitable consistency.

3.3 Spreadability

The gel showed good spreadability (6.5 g·cm/sec), facilitating easy application on the gingival surface.

3.4 Drug Content

Clove oil content was uniform ($98.2\% \pm 1.3$), confirming adequate dispersion and mixing.

3.5 Antimicrobial Activity

Zone of inhibition tests demonstrated significant antimicrobial activity against *P. gingivalis* (18 mm) and *F. nucleatum* (16 mm), comparable to chlorhexidine.

3.6 In Vitro Drug Release

Cumulative release of eugenol showed a controlled pattern over 6 hours, indicating sustained activity.

3.7 Stability

The formulation was stable over 90 days with no changes in pH, color, or microbial growth under accelerated storage conditions.

4. CONCLUSION

The clove-based dental gel demonstrated excellent physicochemical properties, antimicrobial activity, and stability. Its natural origin and effective action suggest it as a promising alternative or adjunctive treatment for periodontitis. Further in vivo and clinical studies are recommended to confirm its therapeutic efficacy.



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