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Comparing Herbal Medicines & 0.12% Chlorhexidine for Periodontitis Management: Efficacy, Safety, and Clinical Outcomes

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Abstract

Periodontitis is a ubiquitous and irreversible inflammatory condition of the periodontium caused by the infection of a periodontal pocket arising from the accumulation of sub-gingival plaque. Periodontitis also affects the supporting structures of the teeth (the gingiva, bone, and periodontal ligament), which could lead to tooth loss and contribute to systemic inflammation. Severe periodontitis affects over 11% of adults and is a major cause of tooth loss, negatively impacting speech, nutrition, quality of life, and self-esteem, and has systemic inflammatory consequences. Periodontitis is preventable and treatment leads to reduced rates of tooth loss and improved quality of life. Chlorhexidine (CHX) is one of the most widely and commonly used anti-plaque and anti-gingivitis agents. It is available in different formulations. Chlorhexidine has been used as a broad-spectrum antiseptic since the 1950s. However, it has side effects like dry mouth (xerostomia), altered taste sensations (hypogeusia), specifically salt and bitter, and a discolored or coated tongue. Due to this, herbal alternatives are being explored as they prevent gingival and periodontal diseases due to their anti-inflammatory, antioxidant, and astringent properties. Various parts of medicinal plants help maintain periodontal health. Glycyrrhiza glabra, Ficus religiosa, and Plantago, etc effectively inhibit primary plaque colonizers and periodontal pathogens. This article compares the effectivity of 0.12% Chlorhexidine and herbal medicinal extracts on periodontitis.

Keywords: Chlorhexidine, Ficus Religiosa, Gingiva, Periodontal Diseases

Introduction

Periodontal diseases comprise a wide range of inflammatory conditions that affect the supporting structures of the teeth (the gingiva, bone, and periodontal ligament), which could lead to tooth loss and contribute to systemic inflammation. Periodontal disease initiation and propagation is through a dysbiosis of the commensal oral microbiota (dental plaque), which then interacts with the immune defenses of the host, leading to inflammation and disease. [1]

Severe periodontitis affects over 11% of adults, and is a major cause of tooth loss negatively impacting speech, nutrition, quality of life, and self-esteem, and has systemic inflammatory consequences.[2] The prevalence, extent, and severity of periodontitis were found to increase continually with higher age and there was no age when the onset of disease would most likely occur. [3] A study showed that Periodontal disease was the most common among the older population. Adolescents in selected countries more frequently demonstrated bleeding on probing than adults and older persons. Low- and middle-income countries had higher occurrences of calculus than high-income countries. The prevalence of periodontal pockets was the most frequent in high-income countries. [4]

The rate of periodontitis progression varies largely between patients, and there is no natural threshold for distinguishing the rates of disease progression. The incidence of periodontitis unresponsive to treatment depends on pretreatment progression rate, extent and severity of disease, tooth type, smoking, high levels of putative periodontal pathogens, a deficient immune response, and the type of therapy provided. [5]

Periodontitis is preventable. The treatment minimizes the symptoms and perception of the disease, possibly restores lost periodontal tissue, and provides information on maintaining a healthy periodontium. Therapeutic intervention includes introducing techniques to change behavior, such as individually tailored oral hygiene instructions; a smoking-cessation program; dietary adjustment; subgingival instrumentation to remove plaque and calculus; local and systemic pharmacotherapy; and various types of surgery. [6] To successfully manage periodontitis, dental professionals must understand the pathogenesis, primary etiology, risk factors, contributing factors, and treatment protocols. Careful diagnosis, elimination of the causes, and reduction of modifiable risk factors are paramount for successful prevention and treatment of periodontitis. Periodontal maintenance therapy at a regular interval and long-term follow-ups are also crucial to the success of the treatment and long-term retention of teeth. [5]

Chlorhexidine is one of the most widely and commonly used antiplaque and antigingivitis agents. CHX has been used as a broad-spectrum antiseptic since the 1950s. Its antibacterial action is due to the disruption of the bacterial cell membrane by the chlorhexidine molecules, increasing the permeability and resulting in cell lysis. It can be either bacteriostatic or bactericidal depending on the dose. It is available in different formulations like mouthwash, sprays, varnish, and chewing gums. CHX mouth rinses are available in concentrations of 0.2% and 0.12%.[7] Apart from the benefits, there are certain disadvantages associated with Chlorhexidine. The most common side effects noticed in patients were inappropriate taste or taste disturbance (85.4%), xerostomia (78.1%), and tooth discoloration (58.6%). Other common side effects caused by chlorhexidine are: changes in the oral mucosa, occurrence of burning mouth syndrome, allergic reactions, and discolored silicate fillings. [8] Alternatively. The usage of medicinal herbal extracts is gaining traction to manage gingival and periodontal diseases due to their anti-inflammatory, antioxidant and astringent properties. According to the studies, the antibacterial property of medicinal plants is due to their alkaline nature and prevents plaque and calculus formation by maintaining acid-alkali balance in saliva.[9] Curcumin is a plant-derived polyphenol extracted from turmeric, that bears such favorable properties as anti-inflammation, anti-oxidation, anti-angiogenesis, immune regulation, anti-bacterial, and pro-apoptosis, its application in deterrence and treatment of

periodontal diseases is promising.[10] Other Herbal medicines include extracts from turmeric, Meswak, Neem, Tulsi, pomegranate, chamomile, Eugenol & clove oil, etc.[11]

The Article strives to compare the effectiveness of herbal medicines and 0.12% Chlorhexidine in treating patients with periodontitis. Periodontitis is an inflammatory condition of the Periodontium that can be managed with appropriate treatment. Both CHX and herbal medicinal extracts have shown positive effects in managing the condition. However, there are both advantages and challenges associated with each treatment approach. These will be discussed in this article.

Methodology

To Review the literature, Studies were selected from PubMed, Scopus, Web of Science, and Google Scholar without restrictions on publication year, to provide a comprehensive overview of current knowledge on the effects of Herbal extract and 0.12% Chlorhexidine on Periodontitis. The study focused on a comparative analysis of herbal medicines & chlorhexidine on periodontitis. Relevant keywords and Medical Subject Headings(MeSH) were selected and combined with Boolean Operators Like AND, and NOT. The search terms included- "Chlorhexidine", "plant/ extract/ herb/herbal medicines in dentistry" and "periodontitis". The research encompassed Case Reports, Laboratory studies, Clinical studies & Systemic reviews.

Results

A summary of descriptive characteristics of all included studies related to the effect of Chlorhexidine on different periodontal conditions is shown in Table 1

Table 1: showing a summary of the related CHX studies

S.no	Author/year	Chlorhexidine Concentration/Formulation	Clinical condition	Instructions for Use	Conclusion
1.	Deus FP, Ouanounou A. International dental journal. 2022 Jun 1;72(3):269-77(12).	CHX mouthwash in 0.1% and 0.2% concentration	Gingivitis	15 mL oral rinse, swish, and spit for 30 seconds, 2 times a day (mornings and evenings) following toothbrushing	CHX mouthwash with concentrations between 0.1% and 0.2% exhibits significant anti-inflammatory and antiplaque effects on the gingiva and teeth. Rinsing daily with a 0.2% CHX mouthwash for 4 to 6 weeks also resulted in reduced clinical signs of gingivitis in several studies.
2.	Mummolo S, Severino M, et al. 2019 May 1;33:83-8.(13)	Chlo-SITE is a xanthan gum gel, that contains 1.5% chlorhexidine.	Generalized Periodontitis.	The gels were administrated by using a syringe with a non-traumatic needle. The needle was inserted into the periodontal pocket and the gel was applied around the tooth in a gentle probing manner in an attempt to include the full extent of the pocket. Gel was applied until the pocket was overfilled, leaving a	Xanthan-based chlorhexidine (Xan-CHX) gel offers a great benefit in improving the indices of periodontal disease, proving to be essential as adjunctive therapy in patients with a serious or moderate high chronic adult periodontitis, and of course as part of a program

				residue visible at the gingival margin of all affected sites of the tooth. Care was taken to avoid any tissue injury.	of periodontal treatment.

A summary of descriptive characteristics of the studies related to the effect of various herbal extracts on different periodontal conditions is shown in Table 2

Table 2: showing a summary of the related studies

S.no	Author/Year	Herbal extract	Parameters evaluated	Outcome assessment	Conclusion
1.	J Indian Society of Periodontology. (2020)[11]	2% Turmeric extract	Subgingival plaque	To access the effect of 2% turmeric extract on the microbial levels of Aa, Pg, and Tannerella forsythia (Tf) found in subgingival plaque done at baseline, 21st day, and 45th day.	Evaluation of microbiological parameters showed a significant reduction in Aa, Pg, and Tf levels.
2.	Khalessi A et al (2004)[14]	Salvadora persica (Miswak)	Plaque accumulation, gingival bleeding, and the salivary concentrations of mutants streptococci (MS)	To access the plaque control efficacy of Persica mouthwash (containing an extract of Salvadora persica)	Improved gingival health and lower carriage rate of cariogenic bacteria when compared with the pre-treatment values.
3.	Anirban Chatterjee [1], et al. (2011) [15]	Azadirachta indica (neem) mouthwash	Bleeding on probing and gingivitis respectively, at baseline, after every week till one month.	To evaluate the antigingivitis and antiplaque effect of an Azadirachta indica (neem) mouth rinse on plaque-induced gingivitis.	A. indica mouth rinse is effective in reducing periodontal indices such as Gingival bleeding, and plaque in both groups over 21 days
4.	Yi Zhang et al. (2017) [16]	Eugenol from the essential oil of Syzygium aromaticum (L.) Merr.& L. M. Perry (clove)	Periodontal pathogen P.g	To assess the Antibacterial and antibiofilm activities of eugenol from the essential oil of Syzygium aromaticum (L.) Merr. & L. M. Perry (clove) leaf against periodontal pathogen P.g	Eugenol damaged the cell membrane of P. gingivalis. Eugenol suppressed biofilm formation of P. gingivalis at the initial stage. Eugenol down-regulated the expressions of virulence factor genes related to the biofilm of P. gingivalis. Eugenol is a potential and effective antibacterial additive for periodontitis prevention.
5.	Sajjanshetty Mallikarjun et al. (2016)[17]	Tulsi leaf (Ocimum sanctum) extract	A.a, P.g, P.i	To evaluate the antimicrobial efficacy of Tulsi leaf (*Ocimum sanctum*) extract on periodontal pathogens	At 5% and 10% concentrations, Tulsi extracts demonstrated antimicrobial activity against A.a.
6.	Bhadbhade SJ et al.	*Punica granatum* L.	Pomegranate extract was tested against	To evaluate the effect of a pomegranate-containing mouth	Pomegranate mouth rinse has an antiplaque effect. Pomegranate

	(2011)[18]	(Pomegranate) Extract	(A.a.), (P.g.), and (P.i.).	rinse on plaque.	extract is efficacious against A.a., P.g., and P.i. strains in vitro. Pomegranate mouth rinse should be explored as a long-term antiplaque rinse with prophylactic benefits.
7.	Ashish Agarwal, Bharti Chaudhary (2020).[19]	1% Matricaria chamomilla (Chamomile)	Plaque index, gingival index, sulcus bleeding index, PPD, CAL, GR, stain index) and microbial colony forming units were evaluated at baseline, 6 weeks, and 3 months.	To evaluate and compare the clinical and microbiological effects of Matricaria chamomilla (MTC) mouth rinse for the management of chronic periodontitis.	Significant improvement in the periodontal parameters

Discussion

In dentistry, CHX products are available by prescription and include formulations such as mouthwashes, gels, chips, and varnishes. CHX mouthwash with concentrations between 0.1% and 0.2% exhibits significant anti-inflammatory and antiplaque effects on the gingiva and teeth when used daily over 2 weeks in the absence of mechanical cleaning and as a long-term adjunct to oral hygiene at 4- to 6-week and 6-month intervals. CHX mouthwash at 0.12% is most effective in preventing the development of gingivitis on a plaque-free dental surface; therefore, it is most effective if the patient's teeth were professionally cleaned before its application.

In dentistry, CHX has proven to be an extremely useful antimicrobial in the field of health and its versatility is unmatched as a chemotherapeutic agent when mechanical prophylaxis is not possible. However, Tooth staining was the most negative adverse effect reported by patients.[12] Application of xanthan-based Chlorhexidine (Xan-CHX) gel offers a great benefit in improving the indices of periodontal disease, proving to be essential as adjunctive therapy in patients with a serious or moderate high chronic adult periodontitis, and part of periodontal treatment.[13] However, when comparing CHX dentifrices or gels of 1% and 0.12% to CHX mouthwashes of 0.12% and 0.2%, there is a superiority in the performance delivered by mouthwash concerning plaque with no serious side effects. Although CHX gels do inhibit some plaque growth, when CHX gels and dentifrices are incorporated into a non-brushing model, where mechanical oral hygiene is not feasible, CHX mouthwash should be the first product of choice. [12]

On the flip side, Herbal plant extracts also have a positive impact on treating periodontal conditions in a tooth. This has been performed by using medicinal plants like turmeric, Meswak, Neem, Tulsi, pomegranate, chamomile, Eugenol & clove oil, etc. 2% Curcumin delivered with a nanocarrier system showed results comparable to Chlorhexidine gel and hence shows promising future as a Local Drug Delivery agent in the treatment of periodontal pockets.[11] The study showing the oral health efficacy of Persica mouthwash (containing an extract of Salvadora persica) exhibited improved gingival health and a lower carriage rate of cariogenic bacteria. However, Persica did not reduce the accumulation of dental plaque.[14] 0.19%Azadirachta indica (neem), a Meliaceae family tree, has been used in

India for several decades, has significant anti-inflammatory properties. Thus, it can be used as an adjunct to mechanical therapy for treating plaque-induced gingivitis.[15] The antibacterial effect and mechanism of eugenol from Syzygium aromaticum (L.) Merr. & L. M. Perry (clove) leaf essential oil (CLEO) against oral anaerobe P. gingivalis exhibited antibacterial activity against P.g, at a concentration of 31.25 μM.[16] Tulsi (Ocimum Sanctum) demonstrated effective antimicrobial properties against *A.a*. However, further research assessing the toxicity, durability, and other assessments followed by clinical trials is necessary to explore the potential of Tulsi in combating periodontal conditions.[17] Pomegranate mouth rinse has an antiplaque effect but it should be explored as a long-term antiplaque rinse with prophylactic benefits.[18] Matricaria chamomilla (MTC) mouth rinse suggested added significant benefits over the placebo group over the study period. However, it determined non-significant improvement in PPD and CAL as compared to CHX rinse at 3 3-month periods as compared to baseline.[19]

Conclusion

Periodontitis, an inflammatory condition affecting the tissues that support the teeth, is prevalent massively in the global population. Unfortunately, conventional therapies have not demonstrated sufficient effectiveness, often accompanied by significant side effects. In recent years, herbal extracts have gained attention for their potential in treating periodontitis, with studies suggesting improvements in clinical parameters such as bleeding, pocket depth, plaque levels, and clinical attachment indices. However, these herbal remedies face pharmacological challenges, including poor aqueous solubility, short half-life, and low bioavailability. As a result, further experimental and clinical research is necessary to validate these promising findings and fully understand the therapeutic potential of herbal medicines in periodontitis management. Chlorhexidine is a widely used chemical plaque control agent with numerous clinical applications in dentistry, particularly in periodontics. Available in various formulations, Chlorhexidine has become a staple in periodontal therapy. Despite certain drawbacks associated with the long-term use of Chlorhexidine, it remains the gold standard for chemical plaque control due to its proven effectiveness.

Abbreviation

CHX- Chlorhexidine

PPD- Probing Pocket Depth

CAL- Clinical Attachment Level

GR- Gingival Recession

A.a- Aggregatibacter actinomycetemcomitans

P.g- Porphyromonas gingivalis

P.i- Prevotella intermedia

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