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THE ROLE OF CLOVE IN ALLEVIATING TOOTHACHE

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ABSTRACT

In India, toothaches are a common oral health problem that are frequently brought on by gum disease and dental cavities. Clove powder (Syzygium aromaticum) has long been utilized as a natural toothache treatment in traditional Indian medicine. Eugenol, a bioactive substance with analgesic, anti-inflammatory, and antibacterial qualities, is principally responsible for its efficacy. By numbing the afflicted area and blocking oral infections such Streptococcus mutans, clove powder helps lessen pain. It is widely available, reasonably priced, and frequently used in rural areas with limited access to dental care.Clove powder is not a replacement for expert dental care, even though it provides good short-term relief. In India, where resources are limited, its use into primary care procedures can aid in the maintenance of oral health. "The analgesic and anti-inflammatory properties of clove are discussed in this review article. The sources from: Science Direct's Literature Review, The PubMed Database's research evidence, NIPER Institutional Library Reference Assistance.

INTRODUCTION

For generations, toothaches have been treated with clove oil, a natural medicine. The clove tree (Syzygium aromaticum) yields an essential oil that includes eugenol, a strong natural anesthetic. Although the leaves and buds also contain significant levels of eugenol, the oil extracted from the clove stem has the highest concentration. Although clove oil is a natural remedy for moderate tooth or mouth discomfort, there is not enough scientific proof to support using it in place of visiting an oral healthcare professional. One Clove oil use carries some risks, such as gum inflammation and mouth sores. Consuming clove oil might result in poisoning. The application of clove oil for toothaches will be described in this article. It will outline the potential dangers, adverse reactions, and interactions related to this very scented essential oil. There's nothing more annoying than a toothache. They hurt, and it could be inconvenient to visit a dentist right away. There are natural ways to alleviate pain in addition to using over-the-counter painkillers. Cloves are one of these popular medicines. Cloves have been used for millennia as a method of pain treatment. In the past, therapy involved placing the clove within a cavity or diseased tooth. Their active component may temporarily relieve toothache by numbing the skin they come into contact with. We now utilize clove oil rather than ground cloves. The plant's concentrated, extracted component is clove oil. Continue reading to learn how to use clove oil.

Clove oil has been used as a natural remedy for toothaches for decades. Eugenol, a potent natural anesthetic, is one of the essential oils produced by the clove tree (Syzygium aromaticum). Eugenol is found in considerable amounts in the leaves and buds as well, but the oil that is produced from the clove stem has the highest concentration. Clove oil is a natural treatment for mild tooth or mouth pain, but there isn't enough scientific evidence to back it up as an alternative to seeing an oral healthcare provider. There are hazards associated with using clove oil, including mouth sores and inflammation of the gums. Clove oil consumption may cause toxicity. This post will explain how to use clove oil to treat toothaches. It will describe the possible risks, negative side effects, and interactions associated with this highly fragrant essential oil. A toothache is the most irritating thing there is. They hurt, and going to the dentist straight away could be inconvenient. In addition to taking over-the-counter pain relievers, there are natural methods of pain relief. Among these common remedies are cloves. For thousands of years, people have used cloves to relieve pain. Placing the clove inside a cavity or damaged tooth was the method of treatment used in the past. By numbing the skin it comes into touch with, their active ingredient may momentarily alleviate toothaches. Instead of using ground cloves, we now use clove oil. Clove oil is the concentrated, extracted part of the plant. Eugenol, the main ingredient in clove oil, has both analgesic and antibacterial qualities, which is largely responsible for its effectiveness in treating dental pain. Inhibiting nerve conduction is how eugenol works, which lessens pain perception. Its antibacterial properties also aid in the fight against oral germs, which may lessen discomfort

associated with infections. Clove oil is a common option for short-term comfort due to these qualities, but it's important to realize that it doesn't treat the underlying issues that cause dental pain, including cavities or infections. Therefore, for long-term oral health, getting professional dental care is still essential, even though clove oil can be a helpful temporary fix. Clove oil application needs to be handled carefully. Before applying clove oil to the affected region, it is advised to dilute it with a carrier oil, such as coconut or olive oil, to reduce the possibility of adverse effects. The diluted mixture can be gently applied to the area of pain using a cotton swab. Avoiding clove oil ingestion is essential because it can cause negative side effects like nausea, vomiting, or even more serious issues. Furthermore, using clove oil in the mouth frequently or for an extended period of time may irritate the mucosa or harm soft tissues. People should also be mindful of possible allergic responses, which might show up as breathing problems, skin rashes, or itching. People should also be mindful of possible allergic responses, which might show up as breathing problems, skin rashes, or itching. Before using, a patch test can be carried out to help ascertain sensitivity. To ascertain sensitivity, a patch test should be performed before usage. Furthermore, because there aren't enough thorough research on clove oil's safety in these populations, it is not advised for usage in youngsters, pregnant women, or nursing mothers. To ensure safety and appropriateness, it is always important to speak with a healthcare provider before taking clove oil for tooth discomfort. Nature Cure Lab In addition to its analgesic qualities, clove oil has strong antimicrobial activity. Research has shown that eugenol can prevent the growth of several oral pathogens, such as Streptococcus mutans and Candida albicans, which are frequently linked to dental caries and oral infections. This antimicrobial effect adds to the benefits of clove oil for oral health overall and may lower the risk of secondary infections in toothache-affected areas. It's crucial to remember that although clove oil can help manage bacterial load, it shouldn't take the place of professional dental care or standard oral hygiene procedures. Clove oil has advantages, but it must be used sparingly. Negative consequences may result from misuse or incorrect application. For example, immediately applying undiluted clove oil to the oral mucosa or gums can result in chemical burns or tissue irritation. Furthermore, hepatotoxicity and other systemic toxicities have been connected to the systemic absorption of large amounts of eugenol. Therefore, while thinking about using clove oil as a treatment for tooth pain, it's crucial to follow suggested dosage guidelines and speak with medical professionals. In conclusion, because of its analgesic and antibacterial qualities, clove oil, which is high in eugenol, provides a natural substitute for short-term toothache treatment. Scientific evidence demonstrating its effectiveness in bacterial inhibition and pain control supports its traditional use. However, given the possibility of adverse effects and the paucity of thorough clinical research attesting to its efficacy and safety, caution is necessary. To guarantee safe use, appropriate dilution, sparing application, and expert advice are necessary. Clove oil can temporarily relieve dental pain, but it shouldn't be used in place of professional dental care for underlying oral health conditions.

Mechanism of action:- Up to 70–90% of clove essential oil is made up of the active component eugenol, which is largely responsible for the medicinal benefits of cloves in dentistry, particularly for toothaches.

Pain-Relieving (Analgesic) Action Eugenol blocks nerve conduction to produce a local anesthetic effect. It stops the transmission of pain signals by blocking voltage-gated sodium channels on sensory neurons.

Anti-Inflammatory Action: Eugenol decreases prostaglandin synthesis by inhibiting cyclooxygenase (COX) enzymes, especially COX-2. This lessens pain and inflammation in the gums and tooth pulp.

Antimicrobial Action: Clove oil possesses strong antiviral, antifungal, and antibacterial qualities. It damages bacterial cell membranes, causing cell death and the leaking of internal contents. Effective against Candida albicans, Lactobacillus acidophilus, and Streptococcus mutans, among other oral infection Effects of Antioxidants Clove's phenolic components, including eugenol, scavenge free radicals and lessen oxidative stress in oral tissues. This aids in the recovery of injured oral mucosa and irritated gums. Desensitization of Dental Nerves: Eugenol may help desensitize the nociceptive response, which lessens sensitivity to hot or cold stimuli in teeth, by interacting with TRPV1 receptors (transient receptor potential vanilloid 1). Temporary fillings: A common temporary restorative substance is eugenol combined with zinc oxide (ZOE). Dry socket therapy: To reduce pain, eugenol is given topically to the socket. Periodontal therapy: Rinses and gels containing cloves are used to lower the microbial load, gingivitis, and plaque. Root canal dressings: The analgesic and antibacterial qualities of eugenol facilitate root canal treatments. In addition to being utilized in the fragrance and flavoring industries, the essential oil that is produced from the dried flower buds of cloves, Eugenia caryophyllata L. Merr. & Perry (Myrtaceae), is used topically to reduce pain and encourage healing. Carvacrol, thymol, eugenol, and cinnamonaldehyde are examples of phenylpropanoids that are the primary components of the essential oil. Numerous pathogenic bacteria, Herpes simplex, and hepatitis C viruses are among the microbes and parasites on which the biological activity of Eugenia caryophyllata has been studied. Clove essential oil has anti-inflammatory, cytotoxic, insect-repelling, anesthetic, and antibacterial, antioxidant, antifungal, and antiviral qualities. Clove essential oil's chemical makeup and biological effects are discussed in this brief overview, which also contains recent findings from GC/MS analysis and an

investigation of the oil's antibacterial activity against many multi-resistant Staphylococcus epidermidis isolates from dialysis biomaterials. Eugenol (70–85%) and eugenyl acetate (15%) are the two predominant phytochemicals in clove oil, followed by β-caryophyllene (512%). Biological advantages including antibacterial, antifungal, insecticidal, antioxidant, and anticarcinogenic properties are produced by their derivatives.

History and Customary Application

Native to Indonesia's Maluku Islands, often known as the Spice Islands, clove (Syzygium aromaticum) has long been utilized as a traditional treatment for a number of illnesses, particularly those pertaining to the mouth. Clove was brought to India, China, the Middle East, and Africa by ancient sea routes, where it was included into traditional medical systems such as Unani, Ayurveda, and Traditional Chinese Medicine (TCM). Ayurveda (India) : Known as "Lavanga" in Ayurvedic medicine, clove is prized for its analgesic, antibacterial, and Vata-pacifying qualities. Applied to the painful tooth, clove oil or powder is used to relieve toothaches. Mouth rinses are used to treat oral ulcers, gingivitis, and foul breath. Making herbal powders and pastes to strengthen gums. Traditional Chinese Medicine (TCM): Known as "Ding Xiang," clove was used to warm the stomach and kidneys as well as to treat dental pain, bad breath, and oral infections. According to TCM theory, clove's warming properties made it appropriate for reducing toothaches brought on by "cold wind" and dispelling cold in the mouth. Middle Eastern : Unani Medicine The Unani pharmacopoeia included clove (Qaranfal) because of its mukhaddir (anesthetic) and mudir (stimulant) properties. By placing a clove or its extract inside the cavity, it can be used to treat toothaches. Using mouthwashes laced with cloves to combat dental infections. Traditional Medicine in Africa Clove was used by many African civilizations to treat gum infections, mouth sores, and toothaches in both whole bud form and as an infused oil. It was also frequently combined with other aromatic plants to make tooth powders. European Herbalism and Dentistry During the Middle Ages, cloves were brought to Europe by Arab traders and soon gained popularity as a dental cure. European dentists started applying clove oil topically as an anesthetic for dental operations around the 18th and 19th century. Additionally, mouthwashes and teeth powders frequently contained clove oil. Contemporary Dentistry Clove oil is still utilized today as a zinc oxide-eugenol (ZOE) mixture for root canal sealants, dry socket dressings, and temporary dental fillings. The shift from conventional use to scientific confirmation is exemplified by the ongoing use of clove's active ingredient, eugenol, in clinical dentistry. Ancient China: As early as 2000 BCE, cloves were utilized in traditional Chinese medicine to cure a variety of illnesses, including toothaches and stomach problems. Unani Medicine: Another historic medical system that began in ancient Greece and was later embraced by the Middle East and India, Unani medicine also made use of cloves. Traditional Indian Medicine: To treat toothaches, gum disease, and other oral health conditions, cloves are still utilized in traditional Indian medicine. Middle Eastern and African Traditions: Cloves have been used to treat toothaches, digestive disorders, and other ailments in a number of Middle Eastern and African cultures. Folk Medicine: Throughout history, cloves have been used in folk medicine to treat toothaches, frequently in conjunction with other spices and herbs.

Mechanism and Active Compounds: Eugenol: The chemical that gives cloves their analgesic and anti-inflammatory qualities is called eugenol. Antibacterial Properties: Eugenol can aid in the fight against oral infections due to its antibacterial qualities. A toothache is a common dental condition that can seriously affect one's ability to operate on a daily basis and their quality of life. One of the most well-known traditional treatments for dental discomfort is clove powder, which is made from the dried flower buds of the Syzygium aromaticum tree. Clove powder's high concentration of eugenol, a bioactive substance known for its analgesic, anti-inflammatory, and antibacterial qualities, is largely responsible for its therapeutic effectiveness in treating toothaches. This study explores the scientific data supporting the use of clove powder to treat toothaches by looking at its chemical makeup, modes of action, clinical effectiveness, safety issues, and possible uses in contemporary dentistry. The essential oil component of clove powder, of which eugenol makes up between 60 and 90 percent, is primarily responsible for its medicinal qualities. A phenylpropanoid chemical known for its diverse range of biological actions is eugenol. Clove oil's overall pharmacological profile may be influenced by its ingredients, which include eugenol, β-caryophyllene, acetyleugenol, and trace levels of vanillin and flavonoids. Anti-Inflammatory and Analgesic Effects Numerous investigations have shown eugenol's analgesic qualities. By altering ion channels involved in nerve transmission, eugenol reduces pain perception and acts as a local anesthetic. Eugenol's numbing impact when applied topically to tooth tissues can be explained by its considerable local anesthetic effects, which are caused by blocking nerve transmission, according to a study by Prashar, Locke, and Evans.[1] Eugenol's capacity to prevent the production of prostaglandins and other inflammatory mediators is another reason for its anti-inflammatory properties. Eugenol lowers prostaglandin synthesis by inhibiting the activity of cyclooxygenase enzymes (COX-1 and COX-2), which lessens inflammation and related pain. Eugenol may be used as a natural alternative to treat dental pain and inflammation because of this mechanism, which is similar to how non-steroidal anti-inflammatory medicines (NSAIDs) work. Antimicrobial Action Since toothaches are sometimes caused by bacterial illnesses like dental caries or periodontal abscesses, eugenol's antibacterial qualities are very helpful in this situation. A wide range of oral infections have been shown to be

effectively combatted by clove oil. The antibacterial and antifungal properties of clove essential oil were assessed in a study by Kouidhi, Zmantar, and Bakhrouf against 46 yeast strains and 114 streptococcal strains that were isolated from the oral cavity. According to the findings, clove oil shown strong antibacterial action against every strain examined, including Streptococcus mutans, the main cause of dental cavities.[2] Furthermore, it has been demonstrated that clove oil and traditional antibiotics work in concert. In a study by Moon et al., the minimum inhibitory concentrations (MICs) against oral bacteria were significantly reduced when clove oil or eugenol was combined with antibiotics like ampicillin or gentamicin. Clove oil can increase the effectiveness of antibiotics against oral infections, according to time-kill studies that further validated the synergistic relationship.[3]

Clinical Effectiveness in Treating Toothaches: Numerous research have looked into the clinical use of clove oil to treat toothaches. Patients with toothaches received treatment with a paste containing eugenol in a randomized controlled experiment. According to the study, patients who used the eugenol paste reported significantly less discomfort than those in the control group. The scientists came to the conclusion that because of its antibacterial qualities, eugenol not only has acute analgesic effects but also promotes long-term dental health.[4] Another clinical research examined the effectiveness of a gel based on cloves vs the common topical anesthetic benzocaine in children having dental work done. Eugenol's numerous therapeutic benefits are mediated by a number of mechanisms: Ion Channel Modulation: By inhibiting voltage-gated sodium channels in neuronal membranes, eugenol produces local anesthetic effects that reduce nerve excitability and pain perception.[1] Prostaglandin Inhibition: Eugenol lowers prostaglandin synthesis by blocking cyclooxygenase enzymes, which lessens inflammation and related pain.[6] Antimicrobial Action: Eugenol suppresses bacterial growth and biofilm development by rupturing bacterial cell membranes and blocking vital enzymatic processes. This antibacterial activity works especially well against oral infections linked to periodontal and dental cavities.[2] Considerations for Safety and Toxicity : Despite the substantial therapeutic benefits of clove oil and eugenol, their use needs to be handled carefully because high quantities of these substances may have lethal effects. Eugenol can be harmful to human fibroblasts and osteoblastic cells, as shown by in vitro experiments. Its effects include decreased cell viability and suppression of collagen formation. For example, a study by Anpo, Shirayama, and Tsutsui discovered that eugenol reduced the expression of collagen and bone sialoprotein in human dental pulp cells, indicating possible negative effects on the regeneration of dental tissue. Furthermore, excessive consumption of clove oil has been linked to systemic toxicity, including coagulopathy and hepatotoxicity. For this reason, it is essential to use clove oil in the right amounts and under medical supervision. Eugenol is classified as generally recognized as safe (GRAS) by the U.S. Food and Drug Administration (FDA) for use in food; however, its usage in dentistry should be closely managed to prevent negative consequences.[8] Uses in Contemporary Dentistry To improve therapeutic results, the use of clove oil and eugenol in dental materials and procedures has been investigated. A crucial ingredient in many dental formulations, such as periodontal dressings, root canal sealants, and temporary fillings, is eugenol. It is very useful in endodontic treatments to relieve pain and lower the microbial burden in the root canal system because of its analgesic and antibacterial qualities. Recent developments have concentrated on using nanoencapsulation techniques to improve the effectiveness and distribution of eugenol. Using chitosan and poly-γ-glutamic acid, Lee, Choi, and Lee created nanoparticles that included clove oil and thymol, another naturally occurring antibacterial ingredient. According to the study, these nanoparticles showed synergistic antibacterial action against Streptococcus mutans and Streptococcus sobrinus, indicating a viable strategy for the targeted and sustained delivery of eugenol in oral healthcare products. Administration Techniques Depending on the severity of the toothache, user desire, and accessibility, clove can be taken in a variety of ways, each with unique benefits. Clove powder, clove oil, whole cloves, and commercial products like dental gels or pastes are the most widely used types. Use of Clove Oil The most effective and quick-acting remedy for dental pain is clove oil. Eugenol is present in high concentrations (60–90%).

Chemical Composition

Advantages and Challenges: Clove's Benefits for Treating Toothaches: Strong Anesthetic and Analgesic Action By inhibiting voltage-gated sodium channels in nerve cells, eugenol, the main bioactive ingredient in cloves, has a strong local anesthetic effect and lessens the transmission of pain signals. According to Prashar, Locke, and Evans (2006), eugenol is quite successful at temporarily relieving toothaches because its mechanism of action is similar to that of traditional dental anesthetics like benzocaine.[1] Potent Antimicrobial Qualities Several oral infections, such as Streptococcus mutans, Lactobacillus acidophilus, and Candida albicans, are susceptible to clove's antibacterial properties. Eugenol-rich clove oil is useful in preventing and treating infections that frequently result in toothaches because it breaks down bacterial cell membranes, decreases the formation of biofilms, and inhibits bacterial growth, according to studies by Chaieb et al. (2007) and Kouidhi et al. (2010).[2-3] Effects on Inflammation By blocking the cyclooxygenase (COX) enzymes, eugenol also has anti-inflammatory properties by lowering the production of prostaglandins, which are chemicals that modulate pain and inflammation. In animal models, Daniel et al. (2009) showed that clove oil dramatically lowers edema and inflammation, suggesting its potential for treating toothaches associated with pulpitis and gingivitis.[4]

Affordability and accessibility Clove's affordability and accessibility are two of its main benefits, particularly in places with few dental facilities or in rural areas. Because clove oil, powder, or whole cloves are cheap and frequently found in homes, they are useful for emergency situations. Incorporation into Dental Goods Clove-derived compounds are now used in a variety of dental products, including root canal sealants, oral hygiene products, and temporary fillings (zinc oxide-eugenol cements). Eugenol is still one of the few natural substances that is generally acknowledged for its dental uses by both the scientific and traditional populations (Kamatou, Vermaak, & Viljoen, 2012).[5] Clove's Difficulties in Treating Toothaches : Tissue irritation and cytotoxicity Clove is useful in tiny amounts, but when applied directly to soft tissues, undiluted clove oil can result in chemical burns, ulcerations, and irritation of the mucosa. According to Prashar et al. (2006), eugenol has cytotoxic effects on human fibroblast and epithelial cells at higher doses.[1] This presents concerns for excessive or unsupervised usage, particularly in sensitive people and children. Brief Relief The root cause of tooth pain, such as pulp necrosis or bacterial infection, is not addressed by clove oil; it simply offers short-term respite. Eugenol efficiently numbs the region, but it cannot replace definitive procedures like pulpectomy or extraction, according to Jafarzadeh and Abbott (2010).[6] Insufficient Dosage Standardization: The absence of defined dosage and formulation, especially in non-commercial contexts, is one of the main drawbacks of using cloves. The concentration of clove oil or powder used in homemade medicines varies widely, which may result in toxicity or poor treatment. Possible Reactions to Allergies When exposed to clove or eugenol, some people may experience allergic responses that result in respiratory symptoms, mouth ulcers, or contact dermatitis. Its use in general populations may be complicated by these hypersensitivity reactions (Moon et al. 2011).[7] Contraindications and Drug Interactions Since eugenol thins the blood, clove oil may interact with anticoagulants like warfarin. Patients undergoing surgery or those with bleeding issues should not use it. Due to inadequate safety data, pregnant and lactating women are likewise advised to refrain from systemic usage (U.S. FDA, 2025).[8] Taking Advantages and Drawbacks into Account Clove is still a useful natural treatment for temporary dental pain despite its drawbacks, especially in areas with limited access to dental care. Most problems can be greatly reduced with the right instruction on dosage, dilution, and administration techniques. According to Lee et al. (2020), recent advancements like the encapsulation of clove oil in nanoparticles for slow-release dental applications show promise in resolving present issues and guaranteeing improved safety and bioavailability.[9]

LITERATURE REVIEW

For millennia, cloves have been utilized in traditional medicine, especially in dentistry. Eugenol, the active component of cloves, has numbing and pain-relieving qualities. Eugenol is an excellent treatment for toothaches and gum discomfort because of its natural analgesic (pain-relieving) and antibacterial properties. Cloves also include anti-inflammatory substances that can help lessen gum and surrounding tooth swelling. Cloves' unique ability to address oral discomfort distinguishes them from other natural treatments. Cloves can provide much-needed relief from a variety of pains, including cavities, sore gums, and post-dental operation pain, without the harsh chemicals present in certain over-the-counter pain relievers.

Cloves' chemical composition is the key to their efficacy. Approximately 70–90% of clove essential oil contains eugenol, a strong anesthetic that can momentarily dull pain. Eugenol provides instant relief by inhibiting pain signals when administered directly to the afflicted region. However, the advantages don't end there. Additionally, eugenol has antimicrobial properties that aid in combating the microorganisms that cause gum disease and tooth decay. Because of this, cloves can be used to treat the root causes of tooth discomfort in addition to relieving pain. Clove oil is frequently thought of as a natural remedy for tooth discomfort. Clove's eugenol functions as an anesthetic, preventing pain impulses and offering immediate relief from gum irritation and toothaches. In dental crises, clove oil is often used to provide instant oil. Clove oil is traditionally put to a warm compress or administered directly with a cotton swab to the sore spot. It is a dependable at-home treatment until you can see a dentist because of its numbing effect, which can assist reduce throbbing discomfort. Clove oil should be used sparingly, though, since excessive usage might irritate the tongue or gums. Clove's remarkable health advantages have led to its inclusion in several dental products in recent years. Clove is known for its antibacterial and pain-relieving properties and is used in toothpaste and mouthwash. These solutions offer a natural substitute for many traditional dental products that involve harsh chemicals, in addition to utilizing the power of clove. Look for dental products using premium clove oils or extracts before making your selection. Natural oral care products that support tooth health without the use of harsh chemicals are becoming more and more popular. Mouthwashes and toothpaste containing cloves are excellent supplements to any oral hygiene regimen since they can improve gum health, reduce plaque, and freshen breath.[10] The high nutritional content of cloves includes: Proteins, Carbohydrates, Calcium, The manganese calcium, The vitamins K, C, E, and A. These substances found in cloves work well to eradicate the fungus infections that cause a number of tooth conditions. Because of its antibacterial, anti-inflammatory, and analgesic properties, cloves can be used to treat a number of dental conditions. They are beneficial for: A thorough strategy for maintaining dental health may involve including cloves in moderation into your oral hygiene routine. But it's crucial to get in touch with a dentist for individualized advice and care. Known for its strong

bioactive component eugenol, clove (Syzygium aromaticum) has long played a significant role in traditional dental procedures throughout many cultures and is currently receiving more and more support from contemporary scientific analyses. Its analgesic, anti-inflammatory, antioxidant, and antibacterial qualities are highlighted in a number of studies; these qualities work together to effectively relieve toothaches and promote dental health (Chaieb et al., 2007; Pramod et al., 2010). According to Daniel et al. (2009), eugenol's ability to prevent prostaglandin formation by inhibiting COX enzymes—more especially, COX-2—correlates with less pain and inflammation in oral tissues in clinical settings. Eugenol can offer similar pain relief to synthetic anesthetics like benzocaine, according to in vitro and in vivo research, particularly in pediatric settings where safety and tolerability are crucial (Hegde et al., 2016; Jafarzadeh & Abbott, 2010).

Important oral pathogens such as Streptococcus mutans, Lactobacillus acidophilus, and Candida albicans, which play a crucial role in the pathophysiology of dental caries, periodontal disease, and oral thrush, are susceptible to the antibacterial properties of clove essential oil (Gupta et al., 2010; Kouidhi et al., 2010). Clove oil has been shown to have significant zones of inhibition against S. mutans in a study by Park et al. (2011), which supports its use in therapeutic oral care products. There is also growing research on the use of clove oil in dental products. Because of its calming and antibacterial properties for the pulp, zinc oxide-eugenol (ZOE) has demonstrated high efficacy as a temporary restorative substance (Kamatou et al., 2012). This formulation is used in dry socket treatment, pulp capping, and root canal sealants in modern dentistry (Lee et al., 2020). According to phytochemical analysis, eugenol accounts for 70–85% of clove oil's effectiveness; however, other components like β-caryophyllene, acetyleugenol, and eugenyl acetate also show pharmacological actions, such as anti-inflammatory and antimicrobial properties (Cortés-Rojas et al., 2014; Anwar & Przybylski, 2012). These substances work in concert to enhance the medicinal benefits of clove oil. Clove oil nanoencapsulation for controlled release in oral settings is an intriguing area of research. When eugenol was encapsulated with thymol in chitosan-based nanoparticles, Lee et al. (2020) found improved stability and efficacy, indicating that tailored delivery methods can prolong the duration of antibacterial action while limiting toxicity. Regarding cytotoxicity, research has shown that high quantities of clove oil may have harmful effects on fibroblasts and osteoblastic cells, however it is normally safe when applied topically and in diluted amounts (Prashar et al., 2006; Anpo et al., 2010). Therefore, it is important to thoroughly supervise its use in therapeutic settings, particularly in immunocompromised or pediatric populations. According to epidemiological research, initiatives based on cloves have a major positive impact on populations with little access to dental care. Cloves are an inexpensive, easily accessible analgesic in resource-constrained environments, and rural health programs are using clove-based treatments in emergency dental care kits (WHO Oral Health Report, 2021). Moreover, eugenol's capacity to desensitize nerve terminals and lessen nociceptive transmission is linked to its interaction with TRPV1 receptors. According to Kothari et al. (2018), this process is especially pertinent when treating dentin hypersensitivity and post-operative dental discomfort. However, traditional use is still limited by standardization and dosage irregularities. Patients may have sub-therapeutic results or, on the other hand, negative side effects such systemic toxicity, ulceration, or mucosal irritation if concentrations are not controlled (FDA, 2025; Moon et al., 2011). Therefore, dilution with carrier oils and avoidance of consumption are recommended by clinical standards. Evaluated the effects of clove-based oral hygiene practices over a six-month period in a recent longitudinal study. In comparison to the control group, participants who used mouthwash infused with cloves showed statistically significant decreases in both plaque index and gingival bleeding ratings. Clove oil is increasingly being used in commercial dentistry formulations, including mouth rinses, oral sprays, and herbal toothpaste. According to studies, these preparations provide long-term advantages for preventing gingivitis and controlling halitosis, especially those with standardized eugenol concentrations (Sendhil Dental, 2024; The White Tusk, 2023).Lastly, investigation on clove's potential in regenerative dentistry is still ongoing. Eugenol may affect the expression of genes involved in pulpal repair and dentin regeneration, according to preliminary research (Tsutsui et al., 2010). Its function may be redefined by these regenerative features from symptomatic alleviation to supporting tissue restoration. In conclusion, the evidence base backs up clove and its derivatives' diverse therapeutic uses in dentistry. As studies continue to explore its intricate biochemical relationships and therapeutic uses, clove oil serves as a link between traditional medicine and contemporary, evidence-based dental treatment. The clove tree yields the popular spice known as cloves. Their primary applications are in mulled beverages and tea. They are a component of gingerbread as well. Beyond this, though, cloves have antiviral and antifungal properties. For this reason, cloves are used to treat a variety of illnesses, including stress, mouth ulcers, asthma, indigestion, coughing, sore gums, and toothaches. Eugenol, a potent anesthetic found in cloves, also functions as an antiseptic to combat germs that can lead to illnesses. Cloves are frequently used in mouthwash and toothpaste because of their potent cavity-fighting properties. In order to soothe the sensitive tooth nerves, dentists also combine clove oil and zinc oxide to make a temporary filling. Here are a few techniques to treat toothaches using cloves. -A Basic Clove Treatment : In order to use this easy cure, put a few whole cloves in your mouth, moisten and soften them with your saliva, and then crush them with your non-painful molars until their pain-relieving oil is

released. After you have done this, press the crushed cloves against your sore tooth for half an hour or more, then spit them out and do it again. Ground Cloves : Cloves that have been ground also work nicely and are easy to prepare. A quarter teaspoon of olive oil must be added after the cloves have been pounded as usual. Before using a cotton swab to the irritated area of your mouth, thoroughly stir the mixture. After applying the cotton swab to the toothache for approximately half an hour, spit it out and wash your mouth with warm, salty water. Cayenne pepper and cloves : A potent toothache treatment is made by combining whole cloves with cayenne pepper. However, it is very common for this mixture to induce a burning feeling for a few minutes after application. Crush a few cloves with equal parts cayenne pepper powder in a small mixing dish. To make a thick paste, add a few drops of water. Then, roll a cotton swab into the mixture to completely coat the surface. To ease the discomfort, apply the covered cotton swab straight to the sore tooth. Keep the cotton away from your gums since the therapy may irritate them. Tea with Cloves : Clove tea has a rich flavor and a pungent scent. Most significantly, it can help relieve your toothache. You can use a teaspoon of cloves in 500ml of hot water to treat a toothache, but there is no recommended dosage for clove tea. However, because clove may have anticoagulant properties, it is best not to drink a much of the tea. This implies that it may thin your blood, which may or may not be beneficial. Apart from its extensive historical application, recent research has continuously highlighted clove's pharmacological importance in dentistry. A thorough analysis by Chaieb et al. (2007), for instance, emphasized the broad-spectrum antibacterial activity of eugenol, which makes it effective against both common oral pathogens and multi-resistant strains like Staphylococcus epidermidis. Given the growing worry over antibiotic resistance and the growing interest in phytotherapeutic alternatives—which are thought to be sustainable and less likely to promote microbial resistance—this is especially pertinent. Additionally, pharmacological studies have verified that the analgesic effects of eugenol are on par with those of synthetic anesthetics. By inhibiting sodium channels, eugenol can efficiently reduce neural excitability, according to Prashar, Locke, and Evans (2006). This is consistent with the anesthetic action of common topical drugs like benzocaine. These characteristics highlight the value of eugenol as a bioactive substance with therapeutic potential as well as a symptom reducer. It is especially useful in dental treatment, where infection and inflammation frequently co-occur, because of its dual action, which provides both numbing effects and antibacterial protection. Eugenol's value in both acute and long-term oral care is further increased by its antioxidative qualities, which may aid in the repair of injured oral tissues. The potential of clove oil to reduce inflammation has also been studied. By preventing prostaglandin synthesis, Daniel et al. (2009) showed in animal models that clove oil dramatically reduced paw edema, confirming its anti-inflammatory function in treating pulpitis and gingival inflammation. These results offer a natural substitute with maybe less systemic side effects, and they provide a biochemical basis for the reported clinical outcomes when utilizing clove-based solutions in dentistry. They also imply a mechanism like to that of nonsteroidal anti-inflammatory medicines (NSAIDs). Furthermore, cloves provide antibacterial synergy in addition to pain relief. Clove oil shown a synergistic impact with traditional antibiotics like ampicillin or gentamicin, improving bacterial eradication at lower antibiotic doses (Moon et al., 2011). This suggests that it may be able to lower the dosage and adverse effects of conventional antibiotics in addition to validating its use as an adjuvant treatment agent. In a time when microbial resistance is a major worldwide problem, this kind of collaboration is particularly important since it allows physicians to use fewer high-dose antibiotics while maintaining therapeutic result. The goal of recent advancements in dental biomaterials has also been to enhance eugenol delivery. For prolonged antimicrobial administration, Lee et al. (2020) created clove oil-based nanoparticles with chitosan, which dramatically decreased Streptococcus mutans viability in biofilms. Clove oil's stability and bioavailability are increased by this encapsulating method, creating new opportunities for its incorporation into preventative dental treatments. In addition to extending eugenol's therapeutic window, nanoencapsulation enables tailored administration, reducing exposure of healthy tissues and promoting localized activity. However, the misuse of clove compounds has been warned about by toxicological studies. High amounts of eugenol may block collagen formation, which is essential for tissue repair and regeneration, according to Anpo et al. (2010), who also emphasized the cytotoxic effects of eugenol on human dental pulp cells. This emphasizes how crucial careful application is, especially for formulations intended for long-term use or direct pulp capping. Therefore, clinical protocols utilizing clove oil must strike a balance between safety concerns and the oil's strong bioactivity, particularly in patients with impaired mucosal integrity or in pediatric and geriatric populations. Cloves have also remained relevant on a cultural level throughout geographies. Clove has been suggested for its warming, germicidal, and carminative qualities in addition to its ability to relieve pain in both Ayurvedic and Unani systems. Clove oil was also used in early dental anesthetic in European herbal traditions. The fact that it is still used today in over-the-counter products like mouthwash, gels, and temporary fillings is evidence of the long-standing confidence in its effectiveness. Cloves continue to be a common home cure for oral health issues in many areas, providing a natural and socially acceptable method of treating dental discomfort that spans generations. Additionally, comparative research are supporting the function of clove in dentistry education and clinical practice. In a randomized trial, for example, Hegde et al. (2016) showed that a gel based on cloves was as effective at relieving pain as benzocaine in pediatric patients having

extractions. Clove's position as a practical, natural substitute is supported by this equivalency, particularly for groups that are sensitive to synthetic anesthetics. Growing patient preferences for natural and holistic care choices are also in line with the allure of employing an anesthetic derived from plants. Clove extract formulations have also been used into preventive dental care products. Eugenol's use in mouthwashes has been demonstrated to lessen gingival bleeding and plaque buildup, confirming its use in both treatment and oral hygiene maintenance. These characteristics show a comprehensive, preventative, and therapeutic pharmacological profile. Clove has the potential to be used as a preventative measure against both acute and chronic dental problems, as well as a regular part of everyday oral hygiene practices as research advances. In conclusion, the body of scientific research clearly demonstrates clove's therapeutic value in dentistry. Its main active ingredient, eugenol, has a variety of therapeutic benefits that have been thoroughly studied in both experimental and clinical settings. These effects include analgesic, anti-inflammatory, antibacterial, and antioxidant properties. It also exhibits promising outcomes in contemporary delivery technologies like nanoparticles and synergistic activity when combined with antibiotics. In conclusion, cloves continue to be an effective natural treatment for infections and tooth pain. Although the foundation was established by its traditional use, contemporary science has confirmed its efficacy and is broadening its uses. Clove-based remedies have the ability to supplement and perhaps replace traditional dentistry procedures as long as use is cautious and dose is regulated, particularly in low-resource environments or for people looking for plant-based substitutes. It appears to have a realistic and growingly important function in integrative dentistry in the future.

SUMMARY AND CONCLUSION

Scientific studies have confirmed the long-standing usage of clove powder, which is made from the dried flower buds of Syzygium aromaticum, as a natural treatment for toothaches. Eugenol, the main active ingredient in cloves, has strong analgesic, anti-inflammatory, and antibacterial qualities. These qualities enable it to fight oral infections like Streptococcus mutans, a primary cause of dental caries, and to dull pain and inflammation. Cloves have been used for millennia to treat a variety of oral health conditions in traditional medical systems like Ayurveda, Traditional Chinese Medicine, and Unani. Eugenol is now an active component of a number of dental treatments, such as antiseptic mouthwashes, root canal sealants, and temporary fillings. Clinical research has also demonstrated that when it comes to treating dental pain, preparations based on cloves can be just as successful as other traditional anesthetics, such benzocaine. Cloves have many advantages, but they should be used carefully. For sensitive people, undiluted clove oil might result in allergic responses, tissue damage, and gum irritation. Overuse or consumption can have harmful effects, particularly in young people or those with liver diseases. Additionally, although clove oil may offer short-term respite, it doesn't address the root reasons of dental pain, which need for expert dental care and include infections, abscesses, and structural tooth damage. The creation of nano-encapsulated clove oil formulations is one example of recent developments in dental research that attempt to increase eugenol delivery, manage dosage, and improve safety. These developments point to a bright future for the use of medicines derived from cloves in emergency and preventative dentistry. In summary, cloves continue to be a useful and affordable natural remedy for toothaches, especially when prompt dental care is unavailable. It provides a safe and efficient way to temporarily relieve pain when taken as directed, diluted, and under the right supervision. It should, however, be viewed as an adjunctive strategy rather than a replacement for expert dental examination and care. Clove's status as a reliable treatment in oral healthcare is guaranteed by its historical use as well as current scientific proof.

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