BOHR International Journal of Current Research in Dentistry
2022, Vol. 1, No. 1, pp. 39–43
https://doi.org/10.54646/bijcrid.007
www.bohrpub.com

Triphala in Endodontics-A Review

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Abstract. Triphala is an ancient ayurvedic medicine with numerous advantages. It's an ayurvedic blend of three different ayurvedic herbs. As a result, the composite material's efficiency will be greater than that of its elements. Shaping and cleaning are important aspects of successful endodontic treatment. A variety of chemicals are used to irrigate the root canals and kill the microorganisms that cause root canal infection. These compounds have their own set of drawbacks. As a result, ayurvedic medications are increasingly being employed in endodontics to offset the disadvantages of traditional chemicals. The effectiveness of triphala in endodontic applications is examined in this review.

Keywords: Triphala, Irrigation, Chelation, Natural Herb, Endodontic Irrigant.

INTRODUCTION

Triphala has been utilised in Ayurvedic (Indian) medicine for about 2,000 years. It's formed from the dehydrated and preserved powder of three distinctive fruits, thus bearing the names tri meaning three and phala which means fruit [1, 2]. Triphala is a vedic compound made up of balanced portions of three dried astringent fruits: Amalaki (Emblica officinalis), Bibhitaki (Terminalia bellirica), and Haritaki (Terminalia bellirica) eaten without seed (Terminalia chebula). Triphala is a mixture made up of equal portions of three tropical fruits mentioned above, all of which have the efficiency to reduce pain, inflammation and reverse aging [3]. Tannic acid is the most important component. Headaches, constipation, and liver diseases have all been treated with it in Indian traditional medicine [4]. According to preliminary research, Tannic acid present in triphala has an antibacterial impact on wide varieties of bacteria. Triphala's benefits include its ease of use, economical, substantivity, good biocompatibility, and germicidal [5, 6]. Many of the biological features of triphala may be the reason for its vital role as an antioxidant. Tannic acid is the most abundant component in the ripe fruit of the above mentioned three myrobalans [8].

Triphala has both nutritive and blood and liver cleansing effects. Its effectiveness as a lubricating laxative is limited due to the presence of anthroquinones. This polycyclic aromatic hydrocarbon helps in bile flow and peristalsis movement. It has a high nutritional value because it contains vitamin C and linoleic oil. Purgatives and demulcent laxatives are sought by persons suffering from bowel irregularity as a result of liver and gall bladder congestion. Except for constipation induced by a lack of vital energy, Triphala is effective for all types of constipation. Herbal medicine is essentially a matter of perspective, with one approach focusing on tonification and the other on removal. However, overemphasising tonification has one drawback: in extreme cases, it can lead to greater stagnation and congestion. Indicating expulsion by the abuse of laxatives is insufficient by then because it depletes minerals and vital vitamins from the body, as well as causing an imbalance of good gut bacteria, resulting in weakness from constant fatigue and reduction in RBCs [1, 2, 9].

The pharmacological effects of triphala is due to its formulation with tannins, quinones, flavones, flavonoids and flavonols, gallic acid, and vitamin C [6].

ROLE OF TRIPHALA IN ENDODONTICS

The role of triphala in root canal therapy is explained below:

As an Irrigant

Artificial and unnatural chemical constituents manufactured as liquid suspensions for its application as endodontic irrigants used in the cleaning of the root canal system, but they has adverse effects like toxicity, allergy, an unpleasant flavour, and expensive [6].

Microorganisms in the oral cavity causes endodontic infection primarily, which are mainly pathogens that can opportunistically penetrate necrotic pulp tissue inside the root canal and initiates infections. When a root canal is infected chronically, the aggregate facultative anaerobic bacteria count increases. The most persistent species in a non-healing root canal is the Enterococcus faecalis, which is a gram positive facultative anaerobe. The Rhizosphere containing microbial community is easily dislodged with sodium hypochlorite (NaOCl), however it has certain limitations. Triphala has been demonstrated to have antibacterial activity against biofilms after three and six weeks. Herbal alternatives to sodium hypochlorite as root canal irrigants prevailed over sodium hypochlorite's numerous negative qualities [2, 10]. Triphala is a safe choice to frequently used root canal irrigants because it is made up of chemicals that have correct physiologic effects as well as anti-oxidant and anti-inflammatory qualities [6, 11].

One of the main goals of biomechanical preparation in root canal therapy is to eradicate these germs from the root canal system [12]. Microorganisms, on the other hand, may persist following conventional root canal preparation in one of these: the tiny tubules of the dentin or in the apical plug of dentin [13]. Because of the exceedingly complicated root canal anatomy, mechanical instrumentation alone is unsuccessful in cleaning the root canal system [14]. As a result, watering should be used in conjunction with cleaning and shaping. Some of the irrigants employed are Sodium hypochlorite (NaOCl), ethylenediaminetetraacetic acid (EDTA), citric acid, chlorhexidine gluconate, hydrogen peroxide, povidoneiodine, etc., [15] NaOCl is most commonly recommended by doctors, according to scientific literature in regards to the irrigant quality. However, there are still concerns about its impact on essential tissues. It causes inflammation and its cytotoxic in nature causing severe pain and eventually necrosis of all essential tissues when it occurs through the root apex and as an add on its high toxicity, obnoxious taste, and its inefficiency in removing the debris attached to the enamel and dentin are also concerned [16]. Herbal alternatives are suggested as a way to get over the drawbacks of currently available irrigants [3].

In their systematic review, Kavalipurapu Venkata Teja et al. discovered that triphala, green tea polyphenol, and Morinda citrifolia were employed in four research [3, 17–19]. Triphala was determined to be the most potent antibacterial agent among the nine herbal agents studied in the Evidence-Based Complementary and Alternative Medicine study, followed by green tea polyphenol and Morinda citrifolia [20].

When comparing triphala to sodium hypochlorite in a study conducted by V P Reshma Raj et al., the Alamar blue assay revealed no cytotoxic characteristics against the L929 murine fibroblast cells [21].

In their review, Ummey Salma et al. discovered that Triphala had substantial antibacterial action against intestinal infections as well as significant biofilm inhibitory activity. This is due to the presence of tannic acid, which is its primary component [17]. In comparison to typical root canal irrigant, Triphala has the extra benefit of being an antioxidant and antiinflammatory agent, making it a good alternative with no adverse effects as that of NaOCl [22, 23].

As an Antimicrobial Agent

Although Enteroccocus fecalis is a minor part of the microbial flora in infected canals, it is a tenacious bacterium that has a significant role in the pathogenesis of apical lesions after root canal therapy. It can live in the root canal as a planktonic bacteria or as a biofilm, and it is typically discovered majorly in failed root canal treatment cases (22–77%) [24]. E. fecalis can withstand extreme environments due to biofilm formation and the organism's physicochemical features, which allow it to adapt to changing environmental and nutritional conditions.. Biofilm protects bacteria against phagocytosis, antibodies, and antimicrobial agents which makes them resistant many folds. This can be linked to the extracellular matrix's protective barrier [25]. After 6 weeks, the mature biofilm exhibits symptoms of mineralization [8, 26].

Because of the fruits' high citric acid content, triphala is an efficient chelating agent and has shown promise in removing the smear layer [27]. Tannic acid, the main component of Triphala, has been shown in various research to have properties like controlling the growth of bacteria and killing the bacteria mainly against gram-positive and gram-negative bacteria. Their method of action is to deactivate microbial adhesins, cell envelope transport proteins, and enzymes [28]. Quinones are hgighly reactive compounds. Vitamin K is a naphthoquinone having antithrombotic properties. They produce free radicals and form irreversible protein complexes, resulting in functional loss. They affect the cell wall devouring the substrates. Flavonoids are antimicrobials that cause antimicrobial action by interacting with cell walls and proteins of bacteria. Microbial membranes are disrupted by lipophilic flavonoids. When tested In vitro, they had a capability to eradicate Vibrio cholerae, Shigella sonnei, and Streptococcus mutans. They help in reducing the incidence of caries in the fissures. Gallic acid is found in every component of Triphala. It helps in protecting liver cells and acts as an antioxidant and inhibits the proliferation of cancer cells. Bioflavonoids and vitamin C aid to speed up the

healing process. Concentration of vitamin C is abundant in E.officinalis fruit juice and gives 45–70% of triphala's antioxidant properties. Triphala boosts neutrophil activity in stressful situations, prevents IL-4 levels from rising, and corrects low IL-2 and interferon levels. Triphala extracts aids in scavenging free radicals which are responsible for producing reactive oxygen species by activating macrophages. It has the potential to be an immunostimulant and an substitute to allopathic immunomodulators [29]. Another component which inhibits vascular endothelial growth factor (VEGF) by inhibiting phosphorylation of the VEGF receptor-2 is chebulinic acid. Because this substance is benign and inexpensive, it can be employed in settings where VEGF suppression is required [30]. The extract from the T. chebula plant helps to prevent the growth of tooth plaque. It inhibits sucrose-induced adhesion and glucan-induced aggregation, both of which aid microbial colonisation on the teeth's surface. This avoids the buildup of acids on the tooth surface, as well as demineralization of inorganic substances like enamel and dentin [6, 31].

Lactobacillus and Streptococcus mutans promote tooth plaque, microbial development, and gingival inflammation, which can be controlled by triphala. Triphala has a comparable effect on plaque as Chlorhexidine mouthwash. The antibacterial activity is attributed to phenolic chemicals and tannins found in ayurvedic formulations such as Triphala Mashire. The activity is similar to that of triphala in that it inhibits the production of gram-positive and gram-negative bacteria in a dose-dependent manner. Triphala and its constituents have antimicrobial characteristics that are efficient against a wide range of germs. HIV-positive patients were shown to have Staphylococcus aureus, pseudomonas aeruginosa, and Klebsiella pneumoniae. Triphala and its components had antibacterial activity against both gram +ve and gram-ve bacteria, implying that active phytochemicals can pass through both bacterial cell walls. The liquified extract is active against P.vulgaris Aureus, S.epidermidis, B.subtilis S.typhimurium, and has a eradicator impact against E.coli and E.aerogens. 10 Staphylococcus aureus, E. coli, Pseudomonas aeruginosa, Staphylococcus epidermidis, Salmonella typhii, and Enterobacter aerogenes are all susceptible to the thriphala. Salmonella typhimurium is a kind of Salmonella. Triphala suppresses the growth of Enterococci, a type of bacteria that can cause nosocomial bacteremia, surgical site infections, and UTIs. Triphala had a wide inhibitory zone against Enterococci [2, 32].

Endodontic therapy is successful when the canal is disinfected and shaped with a mix of chemo-mechanical instrumentation. Irrigants for root canals help disinfect canal systems that are inaccessible to biomechanical pretreatment. Today, a large range of artificial irrigants are in markets, however some exhibit ineffectiveness and some has adverse reactions and toxicity. Natural substitutes could be beneficial. The removal of all viable or dead tissues, bacteria, and microbial products from the root canal system is the goal of endodontic therapy. This can be accomplished through chemo-mechanical root canal debridement [33]. Combined action of mechanical canal preparation and irrigation is required to decrease the microbial content in the system due to the intricate architecture of the pulp dentin complex and the existence of numerous inconspicuous locations. E. faecalis is an enteric gram-positive bacterium that can grow in the root canal on its own [34]. It is most commonly found in those root canals that have had failed endodontic therapy [24, 35].

Tannic acid has been demonstrated to have antibacterial properties in preliminary investigations, albeit it is not as effective as chlorhexidine. It is safe and made of substances with adequate physiologic effects, as well as anti-oxidative and anti-inflammatory qualities, as compared to regularly used root canal irrigants. The benefits of triphala include its ease of use, economical, substantivity, minimal toxicity, and lack of microbial resistance [18]. It possesses anti-cariogenic and thermogenic properties, as well as the ability to operate as a probiotic. The antimicrobial activity of triphala was demonstrated in this work by measuring the zone of inhibition against E. faecalis, as Shakouie et al. had previously demonstrated [36, 37].

There is a need for an alternate disinfection measure due to the ongoing increase in antibiotic-resistant bacteria and the negative effects induced by synthetic medications [3].

The antibacterial action of triphala as an irrigant was shown to be comparable to that of NaOCl, according to Divia et al. [3]. In a research by Paridhi Garg, Triphala performed equally well as NaOCl [3, 8]. Triphala extracts will be the irrigant of choice in endodontics, according to Divya Saxena et al. [38], because they have various advantages over NaOCl.

Triphala showed increased effectiveness in microbial decrease in the root canal, according to Divya S et al. [38] Karan Bhargava et al. [39] Triphala was found to be more effective against endodontic bacteria. This is owing to its formulation, which contains equal amounts of three different ayurvedic botanicals. Furthermore, diverse compounds may aid in boosting the efficacy of active chemicals and assisting in an additive impact [27]. When compared to 0.5 and 1 percent NaOCl, triphala was more effective on E. faecalis cultures, indicating stronger antibacterial activity [37].

As a Chelating Agent

After instrumentation, a layer of tooth particles, microbes, dead cells and blood together called a smear layer accumulates across the walls of the dentin, according to the literature. Dentine, pulp tissue remains, the odontoblastic process, and microorganisms make up the smear layer. It interfere with root canal sealant adhesion and its penetration into the dentinal tubules. It was found that neutral EDTA solutions weakens organic and inorganic contents in

dentine. Because the quantity of noncollagenous proteins (NCP) diminishes in the apical third, Hulsmann hypothesised that EDTA eliminates not only calcium ions but also calcium linked to NCPs [40]. This portion has a low degree of EDTA decalcification. It's worth noting that Triphala showed enhanced smear layer removal with substantial erosion in the apical thirds, based on the findings [41].

Smear later contains tooth debris that extends a few micrometres into dentinal tubules and has an overall thickness of 2–5 m. Smear plugs can occur as a result of the canal preparation process, which forces smear components into dentinal tubules for different distances. The superficial smear layer and the smear layer material that was packed into the dentinal tubules for a depth of up to 40 m were discovered to be two separate components of the smear layer. Due to capillary action When surface active agents were utilised within, smear was pushed up to a depth of 110 m as a result of adhesion pressures between dentinal tubules and smear, as well as capillary action. Several methods for removing intraradicular smears have been proposed. Various artificial substances have been utilised as root canal irrigants because of their efficacy in removing smear layer and disinfecting the teeth, but they also have drawbacks such as toxicity and allergy potential [6].

In his investigation, Abraham Susan et al. [6] reported that Triphala was very successful and nearly as effective in removing the smear layer. Because of the fruits' high citric acid content, it's an excellent chelating agent and hence has promise for removing the smear layer [42]. In the coronal and middle thirds of the root, triphala was as effective as sodium hypochlorite at removing smear layers, whereas sodium hypochlorite was better at removing smear layers in the apical third [21].

Effect in Microhardness of Root Dentin

Microhardness, permeability, roughness, wettability, and other physicochemical features of human root canal dentin may be influenced by the irrigating solutions. Microhardness testing reveals the loss of inorganic structures in the tooth. The amount of hydroxyapatite in the intertubular substance and the degree of mineral content assist determine the intrinsic hardness properties of dentin structure. As a result, a decrease in dentin microhardness leads to an increase incidence of crack formation and tooth fractures [43, 44].

The decrease in root dentin hardness could be due to a decrease in intertubular dentin matrix stiffness produced by the heterogeneous distribution of the mineral phase within the collagen matrix [45]. other than that, the concentration of NaOCL used determines the microhardness of root dentin. The elastic modulus and flexural strength are inversely proportional to the concentration of NaOCL [46]. Because of its chelating properties, EDTA has a negative softening potential on calcified dentin. The decrease in microhardness of dentin was anticipated since the root dentin's complete cationic receptors are saturated with calcium ions [47]. The results of microhardness tests after doing the root canal irrigation produces values of 5 percent NaOCL and 17 percent EDTA in this investigation were consistent with existing data, which showed reduction in microhardness values after treatment.

When compared to 5% NaOCL and 17% EDTA, Triphala showed reduced degradation in the microhardness of root dentin in a study by Vaishnavi Elika et al. When triphala was employed as an irrigant, Mahsa et al. [48] found that there as no drastic reduction in microhardness of root canal dentin. The citric acid in triphala fruits, which acts as a mild chelating agent, could be the most likely cause of this effect.

CONFLICT OF INTEREST

The authors declare that the review was done in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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