

NOVEL INTRACANAL MEDICAMENTS AND ITS FUTURE SCOPE

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ABSTRACT

The basis of endodontic treatment is elimination of microorganisms from the root canal. Cleaning and shaping is usually not enough to reduce the bacterial count in the root canals. Many resistant microorganisms stay back and continue to multiply increasing the chances of failure of the treatment. Hence intracanal medicaments are necessary and various intracanal medicaments have been tried. Calcium hydroxide is the gold standard but has many disadvantages. Hence there is a need for more research in order to identify the best intracanal medicaments available.

KEY WORDS

Intracanal medicaments, calcium hydroxide, antibiotics, corticosteroids, herbs, bioactive glass.

INTRODUCTION

The basis for successful endodontic treatment is elimination of micro organisms from the root canal (1). Due to the complex nature of the root canal system, cleaning and shaping is often not enough to reduce the bacterial count. A combination of instrumentation, irrigation and intracanal medication is used (2).

Intracanal medicaments are used in Endodontics to complete the work started by instrumentation and irrigation to render the root canal free of micro organisms (3). Though instrumentation and irrigation reduce the bacterial count in the root canal to a great extent, some bacteria mainly *E. faecalis* will stay back and continue to multiply. *E. faecalis* is the most persistent bacteria which may cause flare up or re infection. Various intracanal medicaments like calcium hydroxide, antibiotics, steroids, etc have been tried and calcium hydroxide based intracanal medicaments are the gold standard. There are many disadvantages of the currently available intra canal medicaments. As complete or near complete elimination of micro organisms from the root canal is a challenge there is a need to identify the best intracanal medicament available. This article therefore focuses on the recent advancements in intracanal medicaments in an

attempt to identify the best possible intracanal medicament.

Calcium hydroxide as intracanal medicaments

Calcium hydroxide is the most commonly used intracanal medicament. It has been clinically used to obtain microbial control, dissolve organic remnants, heal periapical inflammation, inhibit inflammatory root resorption, stimulate hard tissue formation and serve as a temporary obturating material between appointments. Its antimicrobial action is related to its high pH, which results in the inactivation of bacterial membrane enzymes (4)

Studies done to test the antibacterial efficacy of calcium hydroxide show that calcium hydroxide is ineffective against *E. Faecalis*. It resists calcium hydroxide for about 10 days (1).

Calcium hydroxide shows limited action against facultative anaerobes and *Candida* species but is effective against obligate anaerobes (3).

Another disadvantage is it is necessary to remove calcium hydroxide completely from the root canal before obturation to obtain a hermetic seal of permanent root filling material (5).

Studies have shown that calcium hydroxide mixed with 2% chlorhexidine digluconate was more effective against *E. faecalis* than calcium hydroxide mixed with other vehicles. Calcium hydroxide is effective to an extent at concentrations of 100 and 200 µgram per mL (2).

Calcium hydroxide intracanal medicaments are helpful in prevention of inter appointment flare ups (6).

Studies show that calcium hydroxide causes weakening of root dentin by 23-43.9% following root canal filling (7).

Corticosteroids as intracanal medicament

Corticosteroid based medicaments acts on the synthesis of lipocortin and vasocortin, inhibiting the formation of edema and A2 phospholipase, enzymes, once inhibiting this enzyme, membrane phospholipids cannot be converted into arachidonic acid. Therefore, the cyclooxygenase and lipoxygenase are blocked. Corticosteroid preparation also acts on histamine, heparin, and bradycinin, which are important chemical mediators in the initial phases of acute inflammation (8). The most common corticosteroid preparation used as intracanal medicament is ledermix paste.

Ledermix paste contains 1% triamcinolone acetonide and 3.21% demeclocycline HCl. Intense staining can be caused by binding of demeclocycline from Corticosteroid based antibiotic containing paste (CAP) to dentine and its photo oxidation when exposed to light. To solve this problem, other Corticosteroid based antibiotic containing pastes have been developed, including Odontopaste (Australian Dental Manufacturing, Brisbane, Australia) with 1% triamcinolone acetonide and 5% clindamycin HCl and Doxypaste (Ozdent, Castle Hill, Australia) with 1% triamcinolone acetonide and 3% doxycycline hyclate. All three pastes contain the same underlying vehicle of polyethylene glycol. Various excipients and fillers are added, which do not exert antimicrobial activities. Doxycycline is more active than demeclocycline as an antibiotic and poses less risk of staining (9). Another study showed that the risk of staining with ledermix paste can be minimised if placed below the gingival margin. It must not be left on the walls of access cavity (10).

Corticosteroid based preparations have shown to cause an increased degree of inflammatory response,

maximum being at 28 days. After 7 days of experiment, all tested substance had low levels of inflammatory cells. Therefore, corticosteroid-based medications can be used for periods no longer than 7 days (8).

Septomixine and pulpomixine are other steroid based pastes used as intracanal medicaments. They contain neomycin and framycetin, respectively. These antibacterial agents are not very effective against microorganisms in the root canal. Dexamethasone is the steroid component of these preparations which is less effective than other corticosteroids. (11).

Chlorhexidine gluconate as an intracanal medicament

Chlorhexidine (CHX) is a broad spectrum antimicrobial agent. The property is due to its cationic bisbiguanide molecular structure. It is bacteriostatic at lower concentrations and bactericidal at higher concentrations. Chlorhexidine gluconate gel is widely used in dentistry as an intracanal medicament. (1) Studies show that Chlorhexidine is more effective in elimination of *E. faecalis* inside dentinal tubules. It has been demonstrated to attain 78% negative cultures after a 7 day application. The disadvantage is that it does not act as a physical barrier against microbial recolonization and does not have any detoxifying ability against endotoxins. Thus, it stays in the canal for a shorter time (5,1). Chlorhexidine both alone and along with calcium hydroxide showed more antibacterial efficacy against *E. faecalis* than calcium hydroxide alone. (5)

Chlorhexidine is successful in elimination of micro organisms associated with persistent infection and treatment failure. This is mainly due to its property of substantivity. (4)

Antibiotics as intracanal medicaments

Multiple micro organisms reside in the root canal and are responsible for infection hence a single antibiotic May not be effective in elimination of bacteria. Therefore a combination of antibiotics called triple antibiotic paste has been used (6). Triple antibiotic paste is a combination of three antibiotics namely minocycline, ciprofloxacin and metronidazole. Triple antibiotic powder, either mixed with normal saline or 2% chlorhexidine, produced the largest zone of inhibition against *E. faecalis*. The minocycline

component is most effective against *E. faecalis*. The triple antibiotic paste is very effective against *E. faecalis* and can be considered a better root canal medicament compared to calcium hydroxide paste (2). Patients with triple antibiotic paste do not develop inter appointment flare up. However, Triple antibiotic paste is shown to be most cytotoxic to human periodontal ligament fibroblasts. It causes exacerbated inflammatory reaction in subcutaneous connective tissue. The minocycline component causes discolouration of teeth (6).

A poly antibiotic paste was used as an intracanal medicament in 1950's. It consisted of penicillin, bacitracin, streptomycin and sodium caprylate (PBSC). The preparation was ineffective against anaerobic species and later. In 1975 the Food and Drug Administration (FDA) banned PBSC for endodontic use primarily because of the risks of sensitization and allergic reactions caused by penicillin (12). Later sodium caprylate was replaced by nystatin- PBSN.

Bioactive glass as intracanal medicament

A study done by Kritika Datta et al shows that bioactive glass can be used as intracanal medicament. It is less effective than 2% chlorhexidine but more effective than calcium hydroxide. (13) Further research is required in the field of bioactive glass to explore its properties as an intracanal medicament.

Intracanal medicaments from nature

Natural and herbal products have been used in medicine and dentistry since time unknown. Use of plant products in medicine is known as phytomedicine or phytotherapy. Since chemical and synthetic products are expensive and cause cytotoxic reactions and are not very efficient in elimination of bacteria, herbal products are used (14).

Propolis

Propolis is prepared from resin collected by bees from trees of poplars, conifers and flowers of genera *clusia* (14). The pharmacologically active constituents in propolis are flavonoids, phenolics and aromatics. Propolis is a good antimicrobial and anti-inflammatory agent, which can serve as a better intracanal irrigant and intracanal medicament. A comparative evaluation on microbial efficacy of propolis, NaOCl and saline

when used as intracanal irrigants indicated that the propolis has antimicrobial activity equal to that of NaOCl (15). Propolis can be used as short-term intracanal medication in cases of pulp and periapical inflammatory processes (16). Mild periapical inflammation has been noticed after exposure to the propolis paste (8).

Curcumin

Turmeric (*Curcuma longa*) is extensively used as a spice, food preservative and coloring material in India, China and South East Asia. It has been used in traditional medicine for the treatment of numerous diseases. Curcumin which is the main yellow bioactive component of turmeric has been shown to have a wide spectrum of biological actions, including antimicrobial, anti-inflammatory and anti-oxidant activities (17).

A study showed that curcumin was able to demonstrate complete eradication of *E. faecalis* (17). Another study showed that there was a gradual decrease in the anti bacterial activity of curcumin at 3 and 7 days which may be due to the buffering ability of dentin. Curcumin does not affect the micro hardness of root dentin and is a potential intracanal medicament (18).

Casearia Sylvestris

It is shown to be an alternative to intracanal medicaments as the alcoholic extract of *C. sylvestris* constitutes a rich source of phospholipase A2 inhibitors. These reduce the acute phase of inflammatory process and prolong the regenerative phase (14). It is partially effective against oedema formation and has lower irritant potential (16).

Green Tea

The poly phenols found in green tea have antimicrobial, antioxidant, anti cariogenic, anti inflammatory properties (15). Green tea has antibacterial property against *E. faecalis* planktonic cells (14).

Arctium Lappa

This plant is popular all over the world for its therapeutic applications. It is found to have antimicrobial action against microorganisms causing

endodontic infections. It is a potential intracanal medicament (15).

Lemon Solution

Lemon solution is a rich source of citric acid. Fresh lemon solution can be used as an intracanal medicament. It is effective against *E. Faecalis* (14).

Nissin

Nissin is a naturally occurring antimicrobial peptide, produced by *Streptococcus lactis* sub species *lactis*. It has antimicrobial activity against a wide range of bacteria and their spores (19). Studies show that it is effective in elimination of *E faecalis* from root canal and is more effective than calcium hydroxide (19).

CONCLUSION

Intracanal medicaments are mandatory in cases like non vital tooth, periapical pathology, periapical or radicular abscess and traumatised teeth. Adequate disinfection assisted by the intracanal medicament reduces the bacterial population and favours the prognosis. This literature has appraised various intracanal medicaments used in root canal therapy. Literatures revealed that the calcium hydroxide which has been considered as a gold standard has so many weak points such as weakening of root dentin and residual calcium hydroxide may interact with root canal sealer and interfere with the hermetic seal. As future scope, further studies are required to improvise the characteristics and properties of newer intracanal medicaments in order to overcome the disadvantages of calcium hydroxide and find a better alternative for calcium hydroxide.

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