

## Review Article

# INTRACANAL MEDICAMENT IN PEDIATRIC ENDODONTICS: A LITERATURE REVIEW

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**ABSTRACT:** The primary aim of endodontic treatment is to remove as many bacteria as possible from the root canal system and then create an environment in which remaining microorganisms cannot survive. Intracanal medicaments have been thought an crucial step in killing the bacteria in root canals; however, in modern pediatric endodontics, shaping and cleaning may be greater importance than intracanal medicaments as a means of disinfecting root canals. Until recently, formocresol and its relatives were frequently used as intracanal medicaments, but it was pointed out that such bactericidal chemicals dressed in the canal distributed to the whole body from the root apex and so might induce various harmful effects including allergies. Furthermore, as these medicaments are potent carcinogenic agents, there is no indication for these chemicals in modern pediatric endodontic treatment. Today, biocompatibility and stability are essential properties for intracanal medicaments Calcium hydroxide has been determined as suitable for use as an intracanal medicament as it is stable for long periods, harmless to the body, and bactericidal in a limited area. Antibiotics form an important part of routine endodontic practice. As topical agents they have been used as an intra-canal pulpotomy/pulpectomy medicament and root canal irrigant. The most important decision in antibiotic therapy should not be about which antibiotic should be used but whether antibiotics should be used at all. This paper reviews the role of intracanal medicament in paediatric endodontics by highlighting their effects, methods, duration and other concerns in detail.

**Key Words:** Intracanal medicaments, Pediatric endodontics, Pulp therapy, Pulpotomy.

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## INTRODUCTION

**I**ntracanal medicament for deciduous teeth aims to maintain the child's health and to sustain deciduous teeth where pulp tissue is affected by caries, dental trauma, or other causes in a functional state until they are replaced by permanent teeth. When the pulp has become irreversibly infected or necrotic, a root canal treatment is indicated. In endodontic therapy of primary teeth, due to the tortuous and complex character of root canals and the change in their morphology with root resorption, 'biomechanical preparation' is restricted only to debridement of the root canals.<sup>1</sup> When this root canal environment is left unfilled, it allows for microbial recolonization in the pulp space,

making it a shelter for microorganisms, their by-products and degradation products of both the, microorganisms and pulpal tissue. Thus, for most favourable success, it becomes essential to place intracanal medicaments within the pulp chamber or canals, which exert their antimicrobial effect by direct contact with the organisms or by way of vapour action of the volatile components that reaches all the irregularities within the canals. Out of all the intracanal medicament, formocresol, 2% gluteraldehyde and iodine-potassium iodide are reported to have excellent antimicrobial activity and vapour-forming effect with minimal toxicity and tissue irritation based on observations made in vitro studies.<sup>2-4</sup>

## **RATIONALE AND APPLICATION OF MEDICAMENT**

Asepsis is the assertion that no bacteria are present in the field of operation. In the course of treating teeth with no signs of canal infection, maintaining asepsis is the primary means of preserving a bacteria-free canal. Antisepsis is the attempt to eliminate infecting or contaminating microbes. In vital pulp extirpation, antiseptic measures are necessary to prevent infection if there is a violation in the chain of asepsis. Irrigating solutions and inter appointment dressings need to be antibacterial in action to avoid any microorganisms which may contaminate the canal system from multiplying and establishing themselves. Sen *et al.* Showed that the bacteria formed dense colonies on the canal walls as well as in inter/intra tubular dentin. Additionally, they observed fungi capable of forming dense, but separate colonies all over the root canal walls.<sup>5</sup>

Disinfection is the abolition of pathogenic microorganisms, usually by chemical or physical means. Disinfection by antiseptic agents is what is attempted in the treatment of infected teeth. Disinfection entails mechanical removal of tissue and debris containing microbes, irrigation and dressing with antiseptic agents; also, surgical removal of an infected apex serves the antiseptic efforts of treatment. It is repeatedly considered desirable to allow hard tissue to form to continue apical root development, to close a wide foramen, or to create a mechanical barrier at a fracture line. Even though the mechanism of action is largely unknown, dressings are available with claims of inducing hard-tissue formation.

Pain diminution can be achieved with pharmacological agents which decrease in the tissue responses in inflammation may have a role in further alleviating clinical pain from both infectious and aseptic pulpo-periodontal inflammation. Constant exudation reflects inflammation, though, residual infection should be assumed. For that basis, treatment is aimed at dealing with impending infection as well as drying or coagulating the exudating surface. Inflammatory root resorption is associated with infection of the root canal combined with physical damage to the cementum; again, a primary function of treatment is to eliminate infection in the root canal. The resorption process may be influenced by medicaments. Antimicrobial agents have regularly been developed and optimized for their activity

against fast growing, dispersed populations containing a single microorganism.<sup>6,7</sup>

Even so, the exceptional result of the treatment of periapical abscess may be related to the reality that the anaerobic microflora is extremely sensitive to the ecological changes caused by the chemomechanical preparation and the local intracanal environment.<sup>8</sup>

## **FREQUENCY OF MEDICATION:**

In accordance with general principles of root canal management, disinfectant dressing should be preferably be renewed in a week and not longer than 2 weeks because dressings become diluted by periapical exudates and are decomposed by interaction with the microorganisms.<sup>9</sup> Traditionally for dressing a root canal, a short, blunt absorbent point moistened with the medicament is carried into the canal or a cotton pledget from which overload medicament has been articulated is placed in the pulp chamber, and the access cavity is sealed. , on the other hand in narrow canals a moist absorbent point does not have sufficient rigidity to be introduced into the canal. In such cases, a dry absorbent is inserted, and a cotton pledget moistened with the medicament is placed against the absorbent point to moisten it. A dry cotton pledget is used to absorb the excess medicament, and the cavity is sealed.<sup>9,10</sup> Many endodontists prefer to dress a root canal with a medicated cotton pellet from which excess medicament has been removed. They depend on the vaporization of the medicament in the pulp chamber for antibacterial action, and they exclude the placing of an absorbent point in the root canal. The vapors arising from the medicament are sufficient to disinfect the pulp cavity.<sup>10</sup>

The exclusion of absorbent point allows room in the canal for the gathering of fluid exudates, reduces the opportunity of periapical irritation from involuntary extension of the medicament or absorbent point into the periapical tissue, eliminates the probable problem of removing a wedged, saturated absorbent point from the root canal during the subsequent visit, and reduces treatment time<sup>10</sup>. The canal is sealed after placing a second sterile dry cotton pellet over the medicated pellet, or placing a seal of temporary stopping over the medicated pellet and completing the double seal with a temporary

outer seal of Cavit, Zinc Oxide Eugenol cement or IRM.

## PROPERTIES OF INTRACANAL MEDICAMENT

### Duration

To be effective, most agents should remain chemically active during the time between appointments. Phenolics dissipate and may lose their activity within 24 hours.<sup>10</sup> Calcium hydroxide retains antimicrobial activity for prolonged periods and can inhibit regrowth of bacteria. The duration of steroid activity is unknown. Sustained-release delivery systems of various intracanal medicaments have been evaluated in vitro, but their clinical effectiveness has not been clearly demonstrated. Substantivity of tetracyclines has been shown for up to at least 12 weeks and MTAD has been shown to last for up to 4 weeks. Furthermore, application of MTAD to 1.3% NaOCl-irrigated dentine may reduce its substantivity.<sup>11</sup>

### Toxicity

Any chemical that kills bacteria will also kill host cells. Both in vitro (bench type) and in vivo (animal and clinical use) studies show that phenolics and aldehydes are generally potent cell killers. Another potential adverse side effect is allergenicity. Some medicaments act as haptens and alter tissues to become foreign substances, which then elicit an immune response. This action may be responsible for their localized adverse effects on pulp or periapical tissues. Neither calcium hydroxide nor steroid compounds have significant toxicity. Calcium hydroxide has been found to be more successful as an intra-canal medicament, but it has a few limitations and it is difficult to completely remove it from the root canal walls before obturation, which might adversely affect the quality of the apical seal. Recent reports also suggest that, due to its strong alkalinity, it may de-nature the carboxylate and phosphate groups leading to a collapse in the dentine structure. Therefore it is not recommended for long periods<sup>12</sup>. Moreover, it did not totally eliminate bacteria from the root canal system<sup>13,14</sup>

### Taste and Smell

The phenolics in particular possess a pungent odor and foul taste. These medicaments soak into and through the temporary restoration into the oral cavity. Patients report a disagreeable medicinal taste; many find this most objectionable. Some dentists believe that if a patient reports a bad taste, the temporary seal is defective and will leak saliva into the canal; there is no evidence to support this presumption.

### Antibiotics as an intracanal medicament in primary teeth:

Here different intracanal medicaments are applied at each appointment till the canal is disinfected. The use of this method is to prevent the development of resistance to any drug by microorganisms. Sterilization of infected root canal by topical application of a mixture of Ciprofloxacin, Metronidazole and Mino Cycline, in situ.

Research has demonstrated that a mixture of Ciprofloxacin, Metronidazole and Minocycline is useful for sterilization of infected root dentin and that the drug mixture can be applied to root canals. Drug penetrates deeply through the root dentin and eradicates bacteria in the infected root dentin. Metronidazole kills obligate anaerobes commonly found in deep infected root dentin. It cannot kill all bacteria, so minocycline and ciprofloxacin are added in the mixture to eradicate all bacteria. The topical application needs only a low dose of the mixture, and is delivered for only a short period eg. 2 days. Thus any adverse systemic side effects could be minimized, although as a matter of principle the application of antibiotics should be limited if possible.

Antibiotics in different combinations have been tried in root canal dressings and found to be effective.<sup>15</sup> Triple antibiotic paste was successful in the healing of non-surgical, endodontically treated, large cyst-like periradicular lesions<sup>16</sup> and dens invaginatus in a mandibular premolar with a large periradicular lesion<sup>17</sup>. It was found to be effective in the disinfection of immature teeth<sup>31</sup> in dogs, and in inhibiting enterococcal growth.<sup>18,19</sup> Thus, with further research, it could possibly be used as an intra-canal medicament in children



### **Complications and side effects**

Substances applied to the pulp have ready accessibility to the periapical tissues and to the systemic circulation. Thus pharmacologically active chemicals which includes all medicaments must be used with caution. Drug side effects increase the risk for vascular complications due to their physicochemical, pharmacological and galenic-formulation properties. Very acidic or hyperosmolar substances can result in direct tissue necrosis at the site of injection with obliteration of vascular flow.<sup>20</sup> Histopathological analysis revealed areas of necrosis, and granulomatous tissues containing numerous foreign body giant cells in some of the previously reported cases<sup>21,22</sup> or animal studies.<sup>23,24</sup> Treatment protocol of this case was surgical removal of necrotic tissues and extruded materials.<sup>21,22</sup>

### **CONCLUSION:**

Intracanal medicaments in endodontics have been used for the reduction in the number of microorganisms, rendering canal content static, prevention of post treatment pain and to improve anesthesia. Research has shown the toxicity and probable allergenicity of the commonly used intracanal medicament particularly those of phenolic and aldehyde derivatives. With a wide choice of intracanal medicament now available selection should be made according to the special needs of the case in question. Intracanal medicament are effective in reducing the incidence of post treatment pain<sup>25</sup>. Use of intracanal medicament differs from case to case and person to person depending on their clinical experience. Calcium hydroxide is the most useful of all the intracanal medicaments<sup>26</sup>. It has a versatile action and very effective in cases of weeping canal and open root apex. It retains its effectiveness for a long time in the root canal compared to other intra canal medicaments.

Even though antibiotic has broad antimicrobial spectrum, the use of this in root canal has been controversial. One school of thought advocates the use of antibiotic in the root canal taking into consideration of topical and local action.<sup>26</sup>

Another school of thought discourages the use of antibiotics in the root canal because of many

disadvantages like developing allergic reactions and immunologic reactions. Use of only root canal medicament in the control of infections is not advocated<sup>27</sup>. Root canal medicaments are only an adjunct to root canal therapy. Takushige et al. Evaluated the efficacy of poly-antibiotic paste consisted of ciprofloxacin, metronidazole, and minocycline, on the clinical outcome of so-called "Lesion Sterilization and Tissue Repair," LSTR, therapy in primary teeth with periradicular lesions.<sup>28</sup> Results showed that in all cases, clinical symptoms such as gingival swelling, sinus tracts, induced dull pain, spontaneous dull pain, and pain on biting disappeared after treatment, although in four cases clinical signs and symptoms were finally resolved only after retreatment using the same procedures. Thus, gingival abscesses and fistulae, if present, disappeared after a few days.

Efficient biomechanical preparation with copious irrigation along with the use of intra canal medicament will increase the success rate and prognosis of endodontic treatment<sup>29</sup>. Intracanal medicaments in endodontics have been used for a number of reasons in the past and currently. Often, different chemicals or drugs are combined in a "cocktail" in an attempt to elicit a variety of effects with a single application. There is still a controversy whether or not to use an intracanal medicament. But the practice still continues.

Calcium hydroxide is still the intracanal medication that congregates the largest number of ideal properties for the eradication of endodontic infections, control of root resorption, and induction of mineralization. However, the literature has shown that the use of intracanal dressings with antibiotic associated with corticosteroid in the initial phase of the endodontic therapy followed by a Calcium hydroxide dressing can be beneficial for the treatment of progressive root resorption and for periodontal healing. Accurate diagnosis and adequate treatment plan may constitute very complex tasks. In addition to the technical knowledge and clinical experience directed toward the quality of treatment, patient education may favourably influence the survival of endodontically treated teeth. Estrela et al in 1999 investigate the role of vehicles in the antimicrobial effect of calcium hydroxide pastes. Different vehicles have been added to calcium hydroxide in an attempt to enhance its properties.

Scientific reasoning indicates the use of hydrosoluble vehicles (distilled water, saline) associated with calcium hydroxide because of their chemical characteristics of dissociation, diffusibility and filling capability which are decisive for the biological behavior, i.e., antimicrobial qualities and induction of tissue repair.<sup>30</sup>

While our knowledge of persistent bacteria, disinfecting agents, and the chemical milieu of the necrotic root canal has greatly increased, there is no doubt that more innovative basic and clinical research is needed to optimize the use of existing methods and materials, and to find new techniques and materials, or combination of materials, to achieve the goal of predictable, complete disinfection of the root canal system in apical periodontitis.

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