



## Review Article

# A literature review on intracanal irrigants in endodontics

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## ARTICLE INFO

### Article history:

Received 24-02-2021

Accepted 09-03-2021

Available online 16-03-2021

### Keywords:

Intracanal irrigants

Chlorhexidine

Sodium hypochlorite

## ABSTRACT

The success of endodontic procedures depends on various factors like biomechanical preparation, disinfection or sterilization of the pulp space, and at last but not the least i.e. obturation of the canal for disinfection of the prepared canal space, only instrumentation is not abundant. The use of some other aids for this, like endodontic intracanal irrigants are quite necessary and essential for the same.

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## 1. Introduction

Different micro organisms acts differently in the development of peri apical as well as pulpal diseases, that has been clearly shown in the human as well as in the animal studies.<sup>1-4</sup> Different aids such as endodontic files, rotary endodontics, chelating agents, intracana irrigating solution, intracanal medicaments increases the longevity of the endodontic treatment. The chances of longevity of the endodontically treated tooth is more if the infection is eradicated prior to the three dimensional obturation. Some of the root canals found to be very tough for the process of three dimensional obturation, that are present with anastomoses, presence of culde sacs and deltas as well if not treated or cleaned properly.

First of all Kakehashi et al shown the importance of microorganisms resulting in formation of periapical and pulpal lesion.<sup>5,6</sup> The micro of the tooth that is having necrotic pulp, found that it is comprised of both gram positive as well as gram negative bacterial

microorganism with a predominance of anaerobic bacteria.<sup>7</sup> The microorganisms which are found in endodontic treatment failure primarily comprises of more than one species, the most common organism out of all the species is found to be “enterococcus faecalsi”.<sup>7</sup> after than the most common organism belonging to fungal group is found to be “candida albicans”.<sup>8</sup>

### Ideal Requirements of an Irrigant

1. It should be anti-microbial
2. Should have tendency to flush out the debris from the canal
3. It should be biocompatible
4. 4. Should have the tendency to dissolve the necrotic pulp as well as vital pulpal tissue
5. Must act as a lubricant
6. Have the tendency to remove the smear layer
7. Should have the ability to penetration into dentin tubules

Root canal irrigant requisites according to Zehnder are:<sup>9</sup>

1. Should have broad spectrum of antimicrobial activity

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2. Should be highly effective over anaerobic microorganism
3. Should be effective enough to dissolve infective pulpal tissue
4. Should be able enough to stop the effect of endotoxins secreted from the microorganisms
5. Inhibit the formation of smear layer
6. The solution must be intoxic, when it come in contact with the vital tissue

#### Nonbactericidal intracanal endodontic irrigants

Normal Saline, lignocaine (local anesthetic) and distilled water.

#### Bactericidal endodontic intracanal irrigants

1. Sodium hypochlorite
2. Chlorhexidine solution
3. Iodine solution
4. H<sub>2</sub>O<sub>2</sub>, i e hydrogen peroxide solution

#### Chelator solutions

1. EDTA
2. Citric acid
3. MTAD,
4. Tetraclean
5. Maleic acid

Other irrigants, which can be used as an intracanal irrigating solution are as follows:-

1. EAW
2. BDA
3. Ozone
4. Laser

#### 1.1. Sodium Hypochlorite

Most commonly used intracanal irrigant material. It is usually seen in combination with different elements like, sodium, calcium, potassium and magnesium. Sodium hypochlorite is usually used in cleaning of infected wounds in concentration of 0.5%. sodium hypochlorite shows different effects like, sporicidal, virucidal and shows tissue dissolving effect on tissues. Due to presence of these properties, its use primarily get popularized 1920. The sodium hypochlorite solution is easily available, shows high shelf life and present or available at cheap price. The main effectiveness and the capacity of dissolution of necrotic tissue is by the amount of concentration present in the aqueous solution of sodium hypochlorite and same goes for the toxicity of sodium hypochlorite. According to a study<sup>10</sup> they stated that at the time of intracanal irrigation fresh solution of aqueous sodium hypochlorite continuously reaches the canals of the tooth and they stated that , thus the concentration of aqueous sodium hypochlorite

does not play a decisive role. However the efficacy of sodium hypochlorite solution can be enhanced by warming at low concentration and ny warming at low concentration its other properties like antibacterial properties as well as efficiency of tissue dissolution also enhanced. According to a study, they revealed that if the temperature rise of sodium hypochlorite is done by 25 degrees, the efficiency of sodium hypochlorite if enhanced by 100 times. Formation of ultrasonic energy with the help of small file in the canal filled with the aqueous solution of sodium hypochlorite which leads to the development of energy ultrasonic which results in warms the solution in the canal. The vibrations cause movement of aqueous NaOCl into the ramifications in the canal, this effect being called as “acoustic streaming.”<sup>11</sup>

#### 1.2. Chlorhexidine

The main function or the prime efficacy of chlorhexidine id due to the presence of its positively charged ions being attracted by the negatively charged ions which were present over the cell wall of the bacteria and finally results in increasing the permeability of the bacterial cell wall and which results in leaching out the contents of the bacterial proteins through the permeable membrane. The main bacteriostatic properties of the chlorhexidine solution start occurring at low concentration. And at higher concentration it simply shows the bactericidal effects which finally results in the coagulation as well as precipitation of the cytoplasmic membrane.<sup>12</sup> Chlorhexidine function by reacting with negatively charged components at the surface of the bacterial cell wall, which results in damage to the bacterial cell membrane as well as loss of cytoplasmic constituents. And chlorhexidine finally results in damage to the bacterial cell wall that too extensively along with cytoplasmic coagulation, precipitation of the bacterial proteins along with the nucleic acid.

#### 1.3. Iodine solution

Iodine solution found to be one of the solution that shows antiseptic results and helps in disinfection of the root canal. In the literature it as found that it is highly antiseptic against various number of microorganisms. The solution of iodine is itself a bactericidal along with fungicidal, virucidal as well as sporicidal that helps in degrading the proteins, nucleotides along with fatty acids which leads to the bacterial cell wall damage. The major and prime advantage of the iodine solution is that it is found to be less irritating as well as poisonous and instantly reduces the load of the bacteria.<sup>12</sup> Iodine solution has one more and exceptional capability of penetrating the dentinal tubules and even kills the bacterial spores which were present over there. The major disadvantage of iodine solution is it will result in staining of the dentinal tissues.<sup>13</sup>

#### 1.4. Hydrogen peroxide

H<sub>2</sub>O<sub>2</sub> is available in 3% to 5% of concentrations. The antibacterial action and tissue dissolving capability of H<sub>2</sub>O<sub>2</sub> are less than that of NaOCl. Combined action of H<sub>2</sub>O<sub>2</sub> and CHX has better antibacterial action.<sup>14</sup>

#### 1.5. EDTA

Used in as root canal irrigating solution at the concentration of 17% and having the pH 7.<sup>15</sup> Its prime action is by chelating with metallic ions that kills the microorganism by chelating with the metallic ions that were needed for their growth.<sup>15</sup> Its primary function is to remove the smear layer.

#### 1.6. CITRIC acid

Used in concentration of 10-50% concentration which is a demineralizing solution that is used during the endodontic therapy to remove the smear layer from the prepared root canal. Citric acid interferes with the mechanism of action of NaOCl. Citric acid 10% is more biocompatible and effective in removing smear layer than 17% of EDTA

#### 1.7. MTAD

It is a mixture of an antibiotic (3% doxycycline), a chelating agent (citric acid), and a detergent. Citric acid eliminates the smear layer, allowing the doxycycline to pass into the dentinal tubules and cause an antibacterial effect. The protocol for clinical use of MTAD is 1.3% NaOCl for 20 min followed by 5 min application of MTAD.<sup>16</sup>

#### 1.8. Maleic acid

Maleic acid is a mild organic acid used as an acid conditioner in adhesive dentistry at 5-7% concentration. Final irrigation with 7% of maleic acid is more efficient than 17% of EDTA in the removal of smear layer from the apical third of the root canal system, which is a crucial area for disinfection.<sup>17</sup>

#### 1.9. Ozone

It occurs in the environment either in gaseous form or as ozonated water. It is an antiseptic, powerful oxidant, and antibacterial agent. It is a strong oxidizer of cell walls and the cytoplasmic membranes of microorganisms, making it a bactericidal, antiviral, and antifungal agent.<sup>18</sup>

#### 1.10. EAW

is also recognized as oxidative potential water. It is an electrolyzed saline solution and usually utilized to remove the microbial contamination and biofilm from the dental unit piping and tubing. It is able to disturb biofilms by reducing the adhering capability of bacteria to the canal walls by generating a negative isotonic pressure.

#### 1.11. Lasers

Neodymium: Yttrium aluminum garnet lasers have been recently introduced for the disinfection in endodontic therapy. However, it was established that when there was direct contact to the laser, all root canal systems were not entirely eliminated of bacteria and lasers were not superior to irrigation with NaOCl.

#### 1.12. Silver diamine fluoride

A 3.8% of w/v silver diamine fluoride (Ag(NH<sub>3</sub>)<sub>2</sub>F) solution has been developed for intracanal irrigation. This represents a 1:10 dilution of the original 38% of Ag(NH<sub>3</sub>)<sub>2</sub>F solution used for root canal infection.

#### 1.13. Morinda citrifolia juice

Morinda citrifolia juice (MCJ) has a broad range of therapeutic effects, including antibacterial, antiviral, antifungal.

### 2. Source of Funding

No financial support was received for the work within this manuscript.

### 3. Conflict of Interests

The author declares that they do not have any conflict of interests.

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**Cite this article:** Yano N, Fatima A, Jan FM, Singh G, Kumar V, Ulla ST. A literature review on intracanal irrigants in endodontics. *IP Indian J Conserv Endod* 2021;6(1):21-24.