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Review Article

Root Canal Irrigants - What Are We Up to!

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Abstract

The aim of root canal treatment is to eliminate all the vital and necrotic tissues, microbes from root canal system which can be obtained by chemical and mechanical debridement. Contact of irrigating solutions in the entire root canal system is much needed for complete disinfection. This narrative review focuses on the available root canal irrigants, their drawbacks and various other irrigants in the pipeline.

Keywords: Root Canal; Irrigants; Pipeline; Infection

Introduction

Complete disinfection of root canals is a must to achieve 100% success rate with root canal treatments. However, this is not considered as an easy task in clinical practice. Any remnant infection inside a canal would lead to root canal treatment failure. Various irrigating solutions have been practiced for complete elimination of microflora inside a root canal. However, all available irrigants comes with their own limitations. This leads way to the development of better solutions. This narrative review focuses on the available root canal irrigants, their drawbacks and various other irrigants in the pipeline.

- Ideal requirements of a root canal irrigant [1]
- Broad antibacterial activity.
- Dissolve pulp remnants.
- Inactivate root canal associated endotoxins.
- Systemically nontoxic.
- Non-irritant to periodontal and periapical tissues.
- Prevent/dissolve smear layer.

Commonly used root canal irrigants

Sodium hypochlorite

Sodium hypochlorite acts against bacterial spores and viruses. It has the capacity to dissolve necrotic tissues than vital tissues [2]. It has been used as an irrigant in endodontics since 1920s. The opinion on use of a particular concentration of sodium hypochlorite differs among researchers and clinicians. Controversy exists with the percentage of hypochlorite solution being used as an irrigant. Few practitioners use 5.25% of hypochlorite as it is in household bleach. However, importance should be given for the solution to reach tissues effectively rather than the concentration of it. Based on the research data, no rationale exists for use of sodium

hypochlorite solution over 1% [1]. Heated solution or ultrasonic activation of solution might improve the effectiveness of irrigation. The ideal time for the solution to be present in root canal for its effectiveness is yet to be advocated.

Ethylene diamine tetra acetic acid (EDTA)

Though sodium hypochlorite is the preferred irrigant for root canals, it could not dissolve inorganic dentin or prevent the formation of smear layer [3]. Hence, EDTA is used as an effective irrigant for root canal systems. Along with cleaning of root canals, EDTA removes biofilms associated with root canal system. Addition of antibiotic regimen to EDTA irrigation improves the reduction of bacterial load [4]. When EDTA is mixed with sodium hypochlorite, it reduces the available chlorine in sodium hypochlorite and reduces its effectiveness [1]. Hence, it is worth to note that citric acid or EDTA should never be mixed with sodium hypochlorite.

Chlorhexidine

Chlorhexidine (CHX) is an antimicrobial which is widely used as chemical plaque control agent. It is used as 0.1 or 0.2% for plaque control and as 2% for root canal irrigation [1]. CHX is not considered as an effective root canal irrigant as it does not remove necrotic tissue remnants.

Root canal irrigants in the pipeline

Limitations of various commonly used root canal irrigants initiate the need for a better and a gold standard solution. The following are the irrigants in the pipeline:

MTAD

- It is a mixture of tetracycline, acetic acid and Tween 80 detergent (MTAD). It is designed to be used as a final root canal irrigating solution just before obturation.
- Tetracycline in MTAD has low pH, chelator and caused demineralization of enamel and dentin [5].
- Removes smear layer and debris along the entire length of the root canal. This effect of MTAD seems to work better than any other irrigant.
- Does not produce any sign of erosion.
- It works against E.faecalis and less cytotoxic than any other intracanal medicament [6].
- Clinically better results are shown when MTAD is used after sodium hypochlorite irrigation.
- MTAD reaches the apical third of the root canal effectively than any other irrigant.
- Insertion of cotton wrapped broach coated with MTAD inside the canal removes debris from its entire length [7].
- Effectiveness of MTAD against fungal activity is still questionable and needs to be evaluated soon.

Tetraclean

- It is also a mixture of an antibiotic, an acid, and a detergent. Antibiotic used s doxycycline and detergent used is propylene glycol. This makes it different from MTAD.
- The surface tension of tetraclean is less compared to EDTA and sodium hypochlorite [8].
- Various other properties of tetraclean are yet to be studied.

Electrochemically activated solutions

- It is prepared from tap water and low concentrated salt solutions.
- It consists of an anode, cathode and a titanium cylinder.
- The solution made from electrochemical activation is against bacterial spores.
- Electrochemical treatment in anode chamber produces anolytic solution and the same in cahode chamber produces catholytic solution.
- Anolytic solution is also called as superoxidized water and works against bacteria, viruses, fungi and protozoa. It kills 99.99% of microbes in less than 2 minutes of application. It can be acidic or alkaline. However, alkaline catholytic solution is commonly used as an irrigant [9].
- It is safe and acts non-toxic even on vital tissues.
- Irrigation with electrochemically activated solutions produces more open dentinal tubules even in the apical third of the root than EDTA or sodium hypochlorite.

Ozonated water

- Ozonated water is known for its effective bactericidal activity and kills even bacterial spores.
- It is effective in eliminating C.albicans, E.faecalis and neutralizes bacterial lipopolysaccharides [10].

- Few studies have found ozonated water as equivalent or superior to sodium hypochlorite [10,11].
- However, research on its efficacy inside a root canal irrigant is not enough to predict any results. More studies on this are expected to use this bactericidal agent as an effective root canal irrigant.

Photon activated disinfection

- Inactivation of microbes using photodynamic therapy (PDT) has been used in dentistry since long.
- Photosensitizers (eg: methylene blue) are used to produce singlet oxygen or free radicals to cause disruption of microbial cell membrane.
- It works against both gram positive and gram negative bacterial flora.
- Researchers started showing interest to use this concept in root canals to get complete disinfection.
- Research data shows that application of photosensitive dye inside the root canal followed by introduction of laser beam into the canal did not show reduction of E.faecalis in experimental models. However, complete disinfection was achieved with sodium hypochlorite irrigation [12].
- Researchers have suggested that PDT inside a root canal might be considered as an adjuvant to conventional methods. However, modifications in PDT protocol are required [12].

Conclusion

Various new potential irrigants have been reviewed in this article. The newer irrigant solutions could definitely be used as an adjunct to commonly used irrigants such as sodium hypochlorite. Research data on these new ones are scarce and more are expected in the near future. The hunt for the better continues as usual.

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