

Recent advances in endodontic irrigation devices

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Abstract: The endodontic success relies on chemo mechanical preparation, removal of microbial toxins, irrigation and complete obturation of the root canals. The key part of the treatment is hand and rotary instrumentation to eliminate microorganisms from the primary root canal by the action of direct mechanical cleaning. The main goal of instrumentation is to facilitate disinfection, effective irrigation and filling. The intricacy of root canal morphology provides curved apical third, apical deltas, narrow isthmi, oval and ribbon shaped canals cannot be mechanically cleaned. Bacteria can flourish in these untouched areas and it turned out to be a challenging objective to endodontic and also a real cause for pulpal and periapical diseases. Complete disinfection of canal is difficult with single irrigating solution use of two or several irrigating solutions obtain the goals of effective and safe irrigation. Irrigation has been performed with plastic syringe it allows good control of needle depth. The purpose of this article is illuminate the methods of effective and safe irrigation on the latest advancements.

Keywords: Irrigation, Root canal, Irrigant.

1. INTRODUCTION:

Root canal irrigant is needed to aid in disinfection of canals completely. Irrigation is a therapeutic flushing of dentinal debris and it creates a successful obturation. Biomechanical and chemical preparation are used concomitantly in order to debride the root canal system and suitable irrigants are used to debridement and disinfection of root canal system.⁽¹⁾ Without damaging periapical tissues irrigants have tissue-dissolution outcome. For a long period of time individual methods have been offered and created to make root canal irrigants more successful in removing debris and microorganisms from the root canal system.⁽²⁾ With the entire canal wall surfaces irrigants must be brought into direct contact for effective action especially for the apical portion of small root canals. Two categories developed to provide effective delivery they are manual agitation techniques and machine assisted agitation devices.⁽³⁾

GOALS OF IRRIGATION:

The central role in endodontic treatment is irrigation. Irrigants facilitate removal of microorganisms, dentin chips, tissue remnants from the root canal during and after instrumentation. Irrigants also facilitate prevent packing of the soft and hard tissue in the apical root canal into the periapical area. Also some irrigating solutions have cytotoxic potential. It increase the efficiency of instruments, dissolve necrotic tissue, remove debris from lateral and accessory canals. It has germicidal as well as antibacterial properties. Several irrigating solutions have antimicrobial activity, kill bacteria and yeasts and also have a cytotoxic potential.⁽⁴⁾

CHALLENGES OF IRRIGATION:

1. Smear layer:

Smear layer is allowing complete canal disinfection during canal instrumentation and this is composed mainly of inorganic dentine but also holds organic matter such as micro-organisms, odontogenic actions and necrotic pulpal material. Smear layer emergence is largest during motorized canal preparation compared to hand filing.⁽⁵⁾ When the correct irrigants are used removal of smear layer is predictable. During instrumentation use of hypochlorite cannot be avoided and the smear layer is created only on areas touched by the instruments. Careless irrigation with needles introduced only to coronal and middle parts of root canal which leads to incomplete removal of smear layer in apical root canal.⁽⁴⁾

2. Dentin erosion:

Dentin erosion maybe harmful and it must be avoided. Long term exposure of hypochlorite in high concentrations result in reduction in the flexural strength in dentin. Short term irrigation using hypochlorite after EDTA or CA leads to strong erosion of the canal wall surface dentin at the end of chemo mechanical preparation.⁽⁴⁾

3. Biofilm:

Biofilm can be eliminated by mechanical and chemical methods in mechanical elimination by instruments detachment by ultrasonic energy and dissolution by hypochlorite. Chemicals such as chlorhexidine can kill biofilm bacteria if long contact time is allowed. Aim of the treatment is not only to kill the microbes but also to remove them completely.⁽⁴⁾

4. Cleaning of uninstrumented parts of the Root canal system:

In instrumented areas irrigation is better attainable because of the irrigation needle which follow the even path generated by the instruments. cleaning and eliminating of necrotic tissue, biofilms and debris from unmarked areas rely entirely on chemical means, and enough use of sodium hypochlorite is the main factor acquiring the aiming results in these areas.⁽⁴⁾

IRRIGATION DEVICES AND TECHNIQUES:

The welfare and successful of irrigation depends on the means of delivery. Traditionally ,irrigation has been executed with an open-ended needle and a plastic syringe into the canal space. To better label the challenges of irrigation a greater number of novel needle-tip designs and equipment are developed. ⁽⁴⁾

1. Syringes:

Traditionally irrigation has been performed with a plastic syringe and an open ended needle into the canal space commonly plastic syringes of different sizes used for endodontic irrigation. Large volume syringes are difficult to control for pressure and accidents may occur so use of 1 to 5mL is recommended for safety purpose. There should be separate syringes used for each solution because of the chemical reactions between many irrigants. ⁽¹⁾

2. Needles:

Routine use in irrigation is 27-Gauge, 30-Gauge and 31-Gauge needles. Commonly smaller needle sizes are preferred. In recent years several modifications of the needle tip design have been introduced to reduce the safety risks and to facilitate effectiveness. ⁽¹⁾

3. Vibringe system:

Its an irrigation device that combines manual delivery and sonic activation of the solution. Vibringe uses the traditional type of syringe delivery but add sonic vibration. Vibringe allows sonic activation and delivery of the irrigating solution in one step. Vibringe features single button operation, battery charge indicator, white LED light. ⁽³⁾

4. Endo activator:

Endo activator is recently introduced irrigant facilitator. It has portable handpiece and three types of disposable polymer tips of different sizes and it should be flexible and strong and do not break easily. Endo activator system should be able to clean debris from lateral canals, remove the smear layer .⁽³⁾ Endo activator does not provide irrigant to the canal but it simplifies the restoration and penetration of the irrigant in the canal and the application of endo activator simplifies mechanical cleansing and irrigant penetration compared with needle irrigation, with no greater in the risk of irrigant expulsion through the apex. ⁽⁶⁾

5. Endovac:

It depends on a negative –pressure approach. The irrigant is placed in the pulp chamber and it is sucked down the root canal and back up again through a thin needle. Considerably this system brings down the risk related with irrigation near to the apical foramen. Enrichment of the reversed flow of irrigants might be great apical cleaning at the 1-mm level and has a strong antibacterial effect when hypochlorite is utilized. ⁽⁷⁾

6. Rinse endo:

This system is based on a pressure-suction mechanism with 100 cycles per minute approximately. A several studies reported that the risk of over irrigation was comparable with manual and rinse endo irrigation, but higher than with endo Vac system. There is no enough data available to conclude the benefits and risks of rinse endo system. ⁽⁴⁾

7. Ultrasonic irrigation:

It can be used as acontinuous or intermittent ultrasonic irrigation. Ultrasonic energy produces higher frequencies than sonic energy but low amplitudes. In intermittent flushed

ultrasonic irrigation, the irrigant is delivered to the root canal by a syringe needle. The irrigant is then activated with the use of an ultrasonically oscillating instrument. In continuous ultrasonic irrigation the needle is activated by ultrasonic handpiece⁽⁸⁾. Ultrasonic irrigation is related as 'passive' because the aim is for the file not to grab the canal walls, which leads to uneven and uncontrolled dentine cutting. Passive ultrasonic irrigation (PUI) has been shown to be successful in eliminating smear layer and pulp tissue, with the measures being most successful when the file is loose and permits to oscillate freely in the canal.⁽⁹⁾ Several studies shows that one minute of continuous ultrasonic irrigation creates cleaner canals and isthmi in both necrotic and vital teeth.⁽⁸⁾

8. The Quantec-E irrigation system:

This system offered that constant irrigant conflicts during active rotary instrumentation would cause a greater volume of irrigant, higher irrigant contact time and simplifies higher depth of irrigant perforation inside the root canal. Comparing with syringe needle irrigation this should aggregate more successful canal debridement.⁽¹⁰⁾

IRRIGATING SOLUTIONS:

1. Sodium Hypochlorite
2. EDTA and CA
3. Chlorhexidine Digluconate

Other irrigating solutions:

This includes physiologic saline, sterile water, urea peroxide, hydrogen peroxide and iodine compounds. When iodine compounds used alone they lack antibacterial activity and do not dissolve tissue. Iodine potassium iodide has considerable antimicrobial activity but no tissue dissolving capability.⁽⁴⁾

2. FUNCTIONS OF IRRIGATING SOLUTIONS:

1. Dissolve organic and inorganic tissue
2. Remove debris and smear layer
3. It kills bacteria and yeasts
4. Non irritating to the periapical tissues
5. Effective germicide and fungicide
6. Does not interfere with repair of periapical tissues
7. Able to disinfect dentin/dentinal tubules⁽⁴⁾

3. CONCLUSION:

Irrigation has a key role in successful endodontic treatment. The mode of action of various solutions is important for optimal irrigation. Due to the safety factors, capacity of high volume irrigant delivery the newer irrigation devices might change the insight of conventional endodontic treatment. Endo activator, Max-1 probe, vibringe, Rinsendo and Endovac are emerging in an effort to better address the challenges of irrigation.

4. REFERENCES:

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