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RECENT IRRIGATING SOLUTIONS AND SYSTEMS IN PEDIATRIC DENTISTRY: A REVIEW

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ABSTRACT

Incomplete elimination of bacteria mostly during a cleaning and shaping of the root canal system is due to the complexity of the root canal system and the formation of smear layer during instrumentation. The desired functions of irrigating solutions is the washing action to remove debris, reduce instrument friction by acting as a lubricant, facilitate dentinal removal by dissolving inorganic tissues, penetrate to the canal periphery and dissolves organic matter and kills the bacteria and yeast, doesn't weaken the tooth structure and is non irritating to the periapical tissue. Research is still going on to scientifically validate an irrigant solution with ideal characteristics.

KEYWORDS: *Irrigation, Lubricant, Bacteria*

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INTRODUCTION

The primary teeth are as important as the permanent teeth as they act as natural space maintainers apart from their role in mastication, speech, aesthetics as well as development of tooth. The roots of the primary molars unlike anteriors has many ramifications, deltas, lateral canals seen (10 % to 20 %) between the canals make the debridement procedure little difficult so introduction of ideal irrigating solution is the need of hour.[1]The teeth with complex anatomy such as Fins or any other abnormality need chemical debridement as they can be skipped by normal instrumentation. [2]Endodontic treatment in the primary tooth becomes necessary as the developing permanent tooth germ is very close to the roots of the primary teeth and the ample medullary bone spaces favours dissemination of the infection. [3]

The recommended irrigation consist that each canal should be irrigated at least one minute with 5 to 10 ml of chelating solution and after the introduction of MTAD irrigants in the market initial irrigation with 1.3 % sodium hypochlorite for 20 minutes followed by final irrigation with MTAD for five minutes was recommended.[4]

Zehnder stated the ideal requisites of root canal irrigant solution is one having broad antimicrobial spectrum, high efficacy against anaerobic and facultative microorganisms, an ability to dissolve necrotic pulp tissue remanents, ability to inactivate endotoxin, ability to prevent formation of smear layer during instrumentation and is systemically non toxic.

The commonly used irrigating solutions in pulpectomy are Sodium hypochlorite, Clorhexidine, EDTA and Citric acid, Mixture of Doxycycline and Citric acid with Detergent, Tetraclean, Hydrogen peroxide, Maleic acid, Carisolv, Smear

Clear, Electrochemically activated solutions, Ozonated water, Silver diamine fluoride, Ethanol, Herbal irrigants like Triphala and Green tea polyphenols, Miswak, German Chamomile and Tea Tree oil, Morinda Citrifolia.

Sodium Hypochlorite (**Daikin Solution**) though is considered as a gold standard for root canal irrigant but cannot be used at required concentration in children due to unpleasant taste, odor, toxicity, in effectiveness in removing smear layer and in completely irrigating microbes from the infected canal. An accidental extrusion of sodium hypochlorite also can cause immediate severe pain, edema, echymosis, paresthesia due to tissue response.[3]

Sodium hypochlorite showed highest antimicrobial effectiveness against E.faecalis in primary tooth.[5]

Chlorhexidine Gluconate is generally suggested to be used in pulpectomy of necrotic primary teeth at 2 % concentration but it has certain disadvantages like limited action on gram negative organisms, inability to dissolve necrotic tissue and inflammatory responses is seen when it gets accidentally extrudes beyond the root apex.[6]

Silver Diamine Fluoride : 3.8 % of silver diamine fluoride has been used as an irrigating solution when the normal 38 % SDF solution is diluted 1 :10.[7] Ag $(NH_3)F$ can be used as an antimicrobial root canal irrigant to reduce bacterial loads and after 60 minutes of exposure it was seen that it completely killed E. faecalis.[8] The irrigating effect of SDF into the periapical tissues especially in young permanent tooth where there is incomplete root formation should be considered when irrigation protocol is decided.[9]

Ozonated Water: Studies have shown that ozonized water when used with sonification as irrigantshowed comparable results as with 2.5 % sodium hypo chlorite.[10] Agarwal et al stated that ozonated water and green tea could be considered as an alternative to conventional root canal irrigantsin primary teeth.

Maleic Acid Ballal et al reported that final irrigation with 7 % maleic acid for one minute was more efficient than 17 % EDTA in removing smear layer in a primary tooth and in apical third maleic acid showed significantly better smear layer removing ability than EDTA.[11]

Citric Acid (Biological Acid) is biocompatible and least irritating to the periapical tissues than other chealating agentsand is available in concentration from 1 % to 50 % in liquid form.6 % citric acid and endoactivator as irrigantadjunct for primary teeth is beneficial in achieving quality of obturation and alleviating painand is quite effective in removing all the components of the smear layer of the primary teeth.[12]

Hydrogen Peroxide is used in dentistry in the percentage ranging from 1 % to 30 % and has shown greater activity against gram positive bacteria with disadvantage of causing cervical resorption.[13]

Carisolv contains0.5 % sodium hypochlorite along with other amino acids and this agent has been effective in removing smear layer in root canals when used as an irrigant in primary teeth.[14]

Green Tea: Green tea extracts amongst the herbal groups has most effective antibacterial efficacy against E.faecalis inside the canals of primary teeth.[15]They have shown significant antibacterial activity against E faecalis biofilms grown on dental culture thus killing it completely within 6 minutes.[6]

Triphal kills 100 % E. faecal is within 6 minutes and also aids in smear layer removal.[6]

HEBP (1 Hydroxyethylidene 1, 1 Bisphophonate): also known as etidronic acid is a potential alternative to EDTA or citric acid as it shows no short term reactivity with sodium hypochlorite.

EDTA plus cetavlon **(EDTAC),** Tetracycline hydrochloride, Carbolic acid solution, Carisolv, Ethylene glycol Bis NNNN Tetra acetic acid **(EGTA)** have been used as potential irrigant for endodontic treatment of deciduous teeth apart from Azadiractaindica (Neem), Curcuma longa (turmeric), Myristicafragrans (nutmeg), Aloe Vera, Spilanthesacmella (Anti toothache plant), German Chamomile, Green tea, Propolis, Miswak, Myrobolan (Terminalia chebula) are the herbal products that have been studied as intracanal irrigants for primary teeth**.**

Endovac System is a new irrigation system which consists of an evacuation tip attached to the syringe of irrigant and has a high speed suction dental unit which creates a negative pressure and pulls irrigant from the fresh supply in the chamber down into the canal to the tip of the cannula and then into the cannula and finally out through the suction hose. [16]It was seen to be more effective than conventional needlein removal of smear layer from the apical third of the root canal system of primary molar root canals**.**[17]

Electrochemically Activated Solutions is a mixture of tap water and low concentrated salt solutions which exhibit microbicidal activity against the bacteria virus's fungi and protozoa and has an advantage like removal of debris and smear layer even at the apical third and isnon toxic. It was seen to be as effective as sodium hypo chloride when used as an irrigant and necrotized pulpectomy primary teeth and is also used as an alternative for irrigating the primary teeth.

Antibacterial Nano Particles have broad spectrum of antimicrobial activity and a study demonstrated that 0.1 percent 2.2 % nano silver gel is more effective on Enterococcus faecalis biofilm when compared to camphorated phenol and Chlorhexidine gluconate.[18]

Anti Microbial Photodynamic Therapy is a two step procedure which involves the application of photosensitizers followed by light illumination of the tissue leading to killing of microorganisms and nowadays is used as a supplement to traditional protocols for canal disinfection.[19]

PIPS (Photon Induced Photo Acoustic Streaming) is based on real firing strip tip with laser impulses of 20 MG at 15 Hz for an average power of.3 Watt at 50 μsec impulses.

Unlike normal laser applications PIPs tip is not mandatory to be placed in the canal but it can be placed in the pulp chamber only and this procedure can remove vital and non vital tissues, kill bacteria and disinfects dentinal tubules in the ramifications and the optical part of the canals also.[20] Ordinoloet al used effective PIPs using 6 % sodium hypochlorite for removing the biofilm and it showed an improved cleaning of the infected dentine.

Gentle Wave Irrigation aims to clean root canal through generation of different physiochemical mechanisms including broadspectrum sound waves which are initiated at the gentle wave handpiece tip which is positioned inside the pulp chamber. Haapasalo et al concluded that GW system provided dissolution of 8 to 10 times faster than ultrasonic devices and needle irrigation respectively.[21]

Vatae System is an irrigation device of integral part of self adjusting file root tree system where irrigant is delivered with disposable silicone tube to the endodontic file. [22]

CONCLUSION

Irrigants help in removing the smear layer by dissolving the necrotic debris and removing bacteria from the root canal system thus help in achieving the main goal of pulpectomy to make the root canal system bacteria free. Herbs like Tulsi, Miswak, M. Citrifolia, Greentea, Chamomile have a potential to replace the commonly used chemical in pediatric dentistry

as they are safe, less toxic, antibacterial, and antioxidant. Due to safety factors, capacity of high volume irrigant delivery and ease of application newer irrigation devices have changed the insight of conventional endodontic treatment.

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