CLINICAL STUDY

IRRIGATING ROOT CANAL : TECHNIQUES,COMPLICATIONS AND MANAGEMENT

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INTRODUCTION

The elimination of microorganisms from the root canal system is one of the objectives of root canal treatment . It is established that microorganisms remain viable after conventional canal preparation, either within the dentine tubules, embedded in the smear layer or bound within the apical dentine plug.It is generally believed that mechanical enlargement of canals must be accompanied by copious irrigation in order to facilitate maximum removal of microorganisms so that the prepared canal becomes as bacteria free as possible.Ideally an irrigant should provide a mechanical flushing action and dissolve remanants of organic tissues without damaging the periradicular tissues.Numerous irrigants have been tried for clinical use,with varying success.

Irrigation with distilled water or saline is effective in eliminating loose debris from the upper and middle thirds of the root canal, but have little affect on the smear layer.

Sodium hypochlorite (NaOCl) is widely recommended and preferred irrigant in root canal treatment because of its microbiocidal and organic tissue-dissolving abilites. However, NaOCl does not effectively remove the smear layer and many in vitro and in vivo studies have reported moderate to severe cytotoxicity with sodium hypochlorite solution when extruded periapically.

Chlorhexidine is also widely used irrigating solution,mainly because of its substantivity. Its activity is pH dependent, which is greatly reduced in the presence of organic matter.It has a wide antimicrobial spectrum and is effective against both Gram-positive and Gram-negative bacteria. Chlorhexidine lacks the tissue-dissolving ability.

Decapinol is also being tried as irrigating solution.

EDTA has little if any antibacterial activity but it effectively removes smear layer by chelating the inorganic component of the dentine. Therefore, by facilitating cleaning and removal of infected tissues, removal of smear layer improves the antibacterial effect of locally used disinfecting agents in deeper layers of dentine. It is established that irrigation with combined EDTA and NaOCl removed more debris than with EDTA alone.

Hydrogen peroxide is a widely used biocide for disinfection and sterilization . It is a clear, colorless liquid that is used in a concentration of 3% as irrigating solution. It has greater activity against Gram-positive than Gram-negative bacteria. In endodontics, Hydrogen peroxide has long been used because of its antimicrobial and cleansing properties.It has been particularly popular in cleaning the pulp chamber from blood and tissue remnants, but it has also been used in canal irrigation.

MTAD (a mixture of tetracycline isomer, acid, and detergent, Biopure) is a new product in the quest for a better root canal irrigant, with a pH as low as 2.15.

It is suggested that MTAD is an effective solution for the removal of the smear layer and does not significantly change the structure of the dentinal tubules, when canals are first irrigated with NaOCl, followed by a final rinse of MTAD .

Thus root canal irrigants plays an important role in the debridement and disinfection of the root canal system and is an integral part of root canal preparation procedures Nevertheless, due to the complexity of root canal anatomy, led to the need of improvement in irrigating techniques.With this goal various chemomechanical methods have been applied showing a varying degree of success.Thus an effective delivery system for root canal irrigation is highly desirable.Such a delivery system must have adequate flow and volume of irrigant to be effective in debriding the canal system without forcing the solution into periradicular tissues.Various chemomechanical methods have been applied showing varying degree of effectiveness in disinfecting and cleaning the root canal system. The newer ones are as follows:

a. Endo Vac system

The EndoVac system (Discus Dental, Culver City, CA) is a novel new irrigation system(Fig.1). A delivery/evacuation tip is attached to a syringe of irrigant and the high speed suction of the dental chair (Fig.1A). A small tube attaches either a macro- or microcannula to thesuction (Fig.1B,1C) The delivery/evacuation tip places irrigant in the chamber and siphons off the excess to prevent overflow. The macrocannula is plastic with an open end that measures International Standards Organization (ISO) size 55 with a .02 taper . The microcannula is stainless steel and has 12 small,laterally positioned, offset holes in 4 rows of 3, with a closed end measuring ISO size 32(Fig.1D) As these cannulas are placed in the canal, negative pressure pulls irrigant from a fresh supply in the chamber, down the canal to the tip of the cannula, into the cannula, and out through the suction hose. The microcannula can be used at working length in a canal enlarged to ISO size 35 or larger.

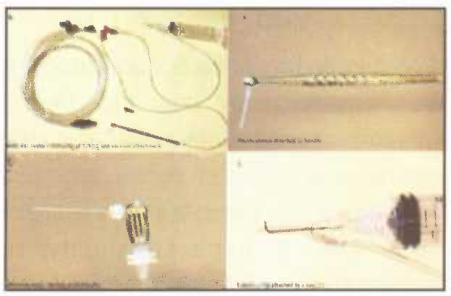

Fig.1 Endo Vac System

b. Irrigation technique with intracanal aspiration

In the intracanal aspiration technique, the irrigant was delivered fromthe tip of an injection needle placed 12 mm from the apical root-end and an aspiration needle that was connected to a apex locator placed 2 and3 mm short of the apical root-end The tip of an injection needle used for delivery of the irrigant and as an active electrod was placed 2.0 and 3.0 mm short of the apical root-end, the tip of the aspiration needle was placed 12 mm from the apical root-end.The cleanliness of the canal was evaluated by scoring smear layer from scanning electron microscopy (SEM) images of the canal.(Fig.2)

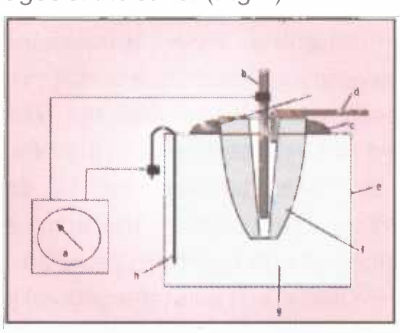

Figure 2. Experimental setup of intracanal aspiration technique (IAT). (a) Root ZX. (b) Aspiration needle. (c) Self-curing resin. (d)Washing needle. (e) Plastic case. (f) Tooth. (g) Coloured agar. (h) Neutral electrode. The irrigant injected from the tip of the washing needle (d) was ejected by the tip of the aspiration needle (b).

c. IrriVac™ Positive & Negative Pressure Root Canal Irrigation Instruments

The IrriVac is available in both a positive needle pressure version and a negative pressure version. one positive pressure IrriVac for dispensing sodium hypochlorite and gross material removal and one negative pressure for final cleaning and irrigation with sodium hypochlorite.IrriVac™Negative Needle Pressure Dispenses solution through the tubing funnel onto the needle and then as it flows down into the canal is safely suctioned up through the needle and removed. The process of pulling irrigating solution down into the canal removing through the end of the needle can provide improved cleansing and disinfection of the apical portion of the canal. IrriVac™ Positive Needle Pressure Dispenses solution through the needle while the suction funnel suctions off spent irrigating solution from the top of the access as the solution flows upward within the canal.

COMPLICATIONS

The irrigating solutions as well technique if not followed properly can be harmful.The possible complications can be:

a. Damage to clothing

the most common incidents during root canal irrigation concern damage of the patients' clothing. As sodium hypochlorite is a common household bleaching agent, even small amounts may cause severe damage.When using an ultrasonic device for root canal irrigation the aerosol may also cause damage. These mishaps should be prevented by proper protection of the patients' clothing. When using hand irrigation, one should assure that the irrigation needle and syringe are securely attached and will not separate during transfer or irrigation in order to prevent leakage over clothing.

b. Damage to the eye

Irrigant, especially sodium hypochlorite

in contact with the patient's or operator's eyes results in immediate pain, profuse watering, intense burning, and erythema. Loss of epithelial cells in the outer layer of the cornea may occur. Immediate ocular irrigation with large amounts of tap water or sterile saline should be performed by the dentist and the patient referred to an ophthalmologist for further examination and treatment.

c. Sodium hypochlorite beyond the apical foramen

The extrusion of sodium hypochlorite beyond the apical foramen may occur in teeth with wide apical foramina or when the apical constriction has been destroyed during root canal preparation or by resorption.

Additionally,extreme pressure during irrigation or binding of the irrigation needle tip in the root canal with no release for the irrigant to leave the root canal coronally may result in contact of large volumes of the irrigant to the apical tissues. If this occurs, the excellent tissue-dissolving capability of sodium hypochlorite will lead to tissue necrosis.Several case reports have described the symptomatology of sodium hypochlorite when injected into the periapical tissues. After wedging the irrigation needle in the root canal, 5.25% sodium hypochlorite was forced beyond the apex of a maxillary right cuspid which led to immediate strong reactions with extreme pain. Within a few seconds the patient's cheek and upper lip showed signs of haematoma and ecchymosis inferior to the right zygoma and profuse haemorrhage from the root canal. Wet compresses continuously applied to the face relieved the pain and the burning sensation felt by the patient. The patient was given antibiotics and analgesics, and the root canal was left open for drainage. Although the swelling increased during the next few hours, the pain had diminished. The patient was advised to replace the cold compresses by hot compresses to stimulate local systemic circulation. One month after the incident the patient's face had returned to normal and root canal therapy could be completed.

d. Allergic reactions to sodium hypochlorite

Hypersensitivity to sodium hypochlorite has been documented. As this reaction was detected before initiation of endodontic therapy, the patient was referred to an allergist. Following a skin patch test, the allergist diagnosed a hypersensitivity to household materials containing NaOCl and recommended not to use NaOCl during root canal treatment. Thus, the root canals were irrigated with Solvidont (DeTrey/Dentsply, Konstanz, Germany) and the procedure was uneventful. In an other case sodium hypochlorite (1%) was used for irrigation of a maxillary central incisor with midroot horizontal fracture.The patient immediately reported severe pain and a burning sensation, within a few seconds the upper lip and cheek up to the infraorbital area became swollen, accompanied by ecchymosis and profuse haemmorhage from the root canal. Pain diminished after a few minutes but the patient complained about problems in breathing and was referred to an emergency care unit. Systemic corticosteroid and antihistamine were administered intravenously and antibiotics were prescribed. Swelling resolved after 3 days, but a paraesthesia on the left side of the face remained for 10 days. Further endodontic therapy was performed with hydrogen peroxide and sterile saline and was uneventful.A skin scratch test was performed some days after the incident and gave a very rapid positive allergic reaction

e. Hydrogen peroxide beyond the apex

It has been reported that hydrogen peroxide when injected out of apical foramen cause injury to periapical tissues. As treatment was performed under local anaesthesia, the patient experienced no pain but complained about a rapidly developing swelling on the upper lip and some difficulty in breathing. The canal was left open, the patient was prescribed antibiotics and instructed to apply cold packs. The emphysema, caused by oxygen liberated from the hydrogen peroxide, subsided in 1 week and root canal treatment was completed. A case was presented of inadvertent extrusionof 40% hydrogen peroxide through the root canals of a maxillary first molar. A sudden swelling appeared accompanied by mild pain.

Examination of the swelling revealed a mildly tender swelling with crepitus. It is probable that a previous infection of the periapical area had provided a pathway for the hydrogen peroxide through the buccal bone to the buccal and facial soft tissues. Under antibiotic therapy the symptoms resolved completely after a few days. After extrusion of hydrogen peroxide (10%) beyond the apical foramen of a right first maxillary premolar. A case was reported with typical symptoms of sudden, severe pain accompanied by a rapid swelling and erythema in the region of the treated tooth. The tooth was immediately extracted by the general dental practitioner and the patient prescribed antibiotics. Two days later the pain had resolved nearly completely, but oedema and erythema were still present. The patient was instructed to use warm mouthrinses for symptomatic relief and take further antibiotics. After 2 weeks the patient had returned to normal. Similar cases of hydrogen peroxide injections into the periapical tissues with identical symptoms have been reported.

f. Air emphysema

Further accidents during endodontic therapy may occur when the root canal is dried with compressed air, which may be expressed through the apical constriction into the periapical tissues. Shovelton (1957) presented 13 cases that had signs of emphysema of the face, the suborbital region, and neck. The main symptom is a crepitus of the swelling. In most cases emphysema during root canal treatment does not require antibiotics or any other therapy; the emphysema in most cases resolves after few days.

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