

## Endo-Activators for A Successful Endodontic Treatment

Ammar Al Raddawi<sup>1</sup>, Mazen Mobayed<sup>2</sup>, Veriko Tevzadze<sup>3</sup>

The University of Georgia, School of Health Sciences

<sup>1,2</sup>Students, Dentistry Program in English; <sup>3</sup>Supervisor, DDM, PhDc

### Summary

The subject that will be reviewed is carrying a type of revolutionary character in therapeutic operative dentistry in general, and it represents the field of endodontic treatment. As in all disciplines of dental medicine, evolution of this field has started from the day of its development, and as a rule in any type of evolutionary processes, there were certain key points during this path. In our case it is the period during problems were actively existent and reaching certain objectives such as: cleaning and shaping the root canal accurately for obturation, removal of the smear layer completely, reaching out to additional root canals, delta canals, and accessory canals in keeping care of the apical foramen and preventing complications like, over irrigation (high toxicity), substances passing to the surrounding tissues, basically reaching an optimum result after the endodontic treatment.

**Key Words:** Endodontic treatment, Cleaning and Shaping, Disinfection, Smear Layer, Endo-activator System.

### Introduction

This article presents consideration and research of several modern aspects of endodontic treatments, including present restorative techniques and materials, diagnostic tools and its influence on today's endodontic practice. Since the clinical practice requires consideration of time management, providence of patient's comfort, complex treatment planning and insurance of result, modern techniques and tools like endo-activators are acting as a "right hand" for the therapist.

### Purpose of Article

To discuss relevant factors associated with patient's health, teeth and the dentists that could account for a successful RCT. To highlight the avoidance of incorrect or unnecessary treatment interventions due to the rapid evolution of dentistry, therefore refreshing the therapist's knowledge is needed.

### Overview

The use of root canal treatment and endodontic root treatment is a very important aspect in dentistry as it weighs against the extraction of the tooth. It is estimated that RCT should be considered completed when the tooth is permanently restored and in function. During root canal treatment, the inflamed or infected pulp is removed, and the inside of the tooth is carefully cleaned and disinfected, then filled and sealed with a rubber-like material called gutta-percha. Afterwards, the tooth is restored by the dentist with a crown or filling for protection. After restoration, the tooth continues to function like any other tooth. Successful RCT prevents pain, apical periodontitis, and tooth loss. Unfortunately, it is a real challenge because several clinical conditions can contribute, alone or in combination, for a poor prognosis, namely root canal perforation, overfilling, endodontic and periodontal lesion, root fracture, periapical bio-

film, traumatic dental injury, fracture of instrument, AP, root resorption, etc. Other clinical conditions are mainly tied to cleaning and shaping of the root canal to prepare it for filling. Complications and deformations of the roots like curvature, delta canals and additional foramens create a challenge for the dentist. Considering the importance of maintaining the disinfection of accessory canals and delta canals of the roots and removal of microbes and smear layer is perfect for obtaining the optimal RCT. Root canal instrumentation creates a smear layer that covers all canal walls. This smear layer can harbor bacteria and their products, decrease the dentin permeability to irrigants and medical dressing, and compromise the fluid tight seal of canals after root filling. The smear layer consists of both organic and inorganic components. The organic component is usually a collection of pulpal and bacterial debris whereas the inorganic component is mainly made of dentinal debris. The effect of smear layer on the outcome of root canal therapy (RCT) has been considered a hot topic for long time. The thickness of this layer may vary from tooth to tooth according to several factors including wet or dry cutting of the dentin, size and shape of the root canal, shape and sharpness of instruments, and the type and amount of the irrigating solution. Thus, the total removal of the smear layer is a must if the therapist is looking for a perfect root canal treatment and tooth restoration. Different techniques and materials have been extensively studied to enhance the performance of fillings and restorations of endodontically treated teeth, solutions like EDTA (most effective in removal of smear layer), Sodium Hypochlorite and Chlorhexidine are often used as irrigants for the cleaning and disinfecting of root canals. Studies showed that sometimes the use of only those irrigants is proven to be not fully effective considering the hard to reach areas of the root. Therefore, the use of endo-activators is the perfect solution for perfecting the final result. The Endo-Activator System is used in endodontic treatment by application of sonic energy. The Activator tips are used in conjunction with the handpiece Driver to provide the energy for tip oscillation and vibration. Evidence-based endodontics has shown that cavitation and acoustic streaming improve debridement and disruption of the smear layer and biofilm. Activated fluids promote deep cleaning and disinfection into lateral canals, fins, webs, and anastomoses. A cleaned root canal system facilitates 3-D obturation and long-term success. This article will be talking about those systems (Ultra-sonic, Sonic, FKG filing system), how they work, their types, and effectiveness towards a perfect RCT.

### Endodontic Treatment

#### Indication

Reasons can vary for this type of treatment but the most common can be deep carries due to prolongation of treatment. When carries reach the deep surfaces of the tooth structure and affect the pulp, this can cause pulpitis or other pulp diseases. This indicates removal of the pulp and restoration of the tooth. Pulp exposure during preparation of the teeth can cause the need of endodontic treatment if the therapist was not able to perform direct pulp capping.

### Precautions

Total isolation of the tooth is required as the atmosphere of the microorganisms around the teeth is not frequently known by all the doctors. Rubber dams are the perfect way of isolating the tooth and the exposed pulp from any microorganisms or other structures entering and causing later complications such as secondary caries or post treatment diseases.

### Gate opening

The use of special instrumentation for opening the gates or the openings to have good access to the canals for the following procedures to be perfected.

### Cleaning and shaping

This is the most important step for a successful RCT. Removal and disinfection of all pulp structures and microorganisms fully is the best way to neglect any regrowth inside the root canals. Several instruments are used in this step. Hand files are the old-fashioned way where we have 3 types; K Files, H Files and K Reamers; each having their own function. New technologies are the rotary files where we have different systems like the FKG system and SAF system. These systems made the cleaning and shaping process much easier as they use the crown down technique and have instructions that the therapists should follow and get a perfect result.

### Obturation

Filling up the root canals and other canals: Accessory canals, Delta roots, Curvatures. Gutta percha is the main material used for obturation as it is the most biocompatible and easy to work with when it comes to filling the root canals. Sealants are used to close all the openings on the walls on the canals laterally and help in filling up the lateral space that may be formed due to shrinkage of the gutta percha. Beta and Alpha gutta percha are the two types or so called flowable and sticks, the apical third is filled with the normal gutta percha and cut then the rest is filled up with flowable using the special gutta percha gun for obturation. The therapist then proceeds to capping with composite or any other material to continue the normal crown filling of the tooth.

### Types of Irrigants

Irrigants are substances used to help in cleaning the root canal from smear layer, microorganisms, debris, pulp remnants and any other unwanted substances found in the canals.

### Sodium Hypochlorite (NaOCL)

It is the most common irrigation solution used in root canal therapy. It works as a great purifier and helps in total disinfection of organic material and microorganisms, dissolving vital and necrotic tissues, and mechanical flushing of debris from the canals. 5.25% is the common concentration used for good dissolving of tissues inside the canal, going more than that percentage can be toxic for the tissues surrounding tooth structure therefore a way of activation is used.

### EDTA

EDTA is another one of the frequently used irrigants but usually used before NaOCL, it is applied in 17% concentration for one minute and that can remove the smear layer

and inorganic materials. The best method recommended for irrigation is to follow that with a final rinse of NaOCL to remove any organic remnants.

### Chlorhexidine

Chlorhexidine is another proven solution to have good antimicrobial activity, 2% is as effective as the 5.25% of NaOCL, yet less toxic. The reason it is not used as much as sodium hypochlorite is due to its inability to dissolve necrotic tissue from the canal. Therefore, it is more frequently used with periodontitis as it is less harmful to the underlying tissues than NaOCL.

### Smear layer

Root canal instrumentation produces a layer of organic and inorganic material called the smear layer that may also contain bacteria and their by-products. It can prevent the penetration of intracanal medicaments into dentinal tubules and influence the adaptation of filling materials to canal walls. Researches showed that smear layer removal should enhance canal disinfection.

### Importance of removal

The total removal of this layer is essential for total disinfection and making way for irrigation of the intracanal remnants and other openings in the lateral wall of the canal. Dentinal tubules with active microorganisms can be covered with this layer. The removal of the smear layer can be very complicated and hard to achieve due to many reasons suggested below:

- ◇ Unknown thickness and volume due to the part consisting water.
- ◇ Contains bacteria, their by-products that can proliferate into dentinal tubules.
- ◇ Necrotic tissue remnants that can serve as a reservoir for microbial irritants.
- ◇ Limit the reach of disinfectants into the hard parts of the canal.
- ◇ Can act as a barrier between filling materials and walls, therefore limiting the reach of sealers into the dentil tubules.

### Endo-Activator System

The Endo-Activator (EA) System is used in endodontic treatment by application of sonic energy. The Activator tips are used in conjunction with the hand piece driver to provide the energy for tip oscillation and vibration. Evidence-based endodontics has shown that cavitation and acoustic streaming improve debridement and the disruption of the smear layer and biofilm. Activated fluids promote deep cleaning and disinfection into lateral canals, fins, webs, and anastomoses. A cleaned root canal system facilitates 3-D obturation and long-term success.

### Discussion

Endo-Activator is a sonically driven canal irrigation system. It is presented with a portable hand piece and disposable noncutting polymer tips. It has been shown to include significantly better debris removal and opening of lateral canals when compared to conventional syringe irrigation and passive ultrasonic irrigation. Supplementing the effect of irrigants using sonic or ultrasonic devices have been proposed to improve root canal cleanliness and disinfection.

The results of this study showed that 1 min agitation of NaOCL improved root canal cleanliness after a full-sequence rotary system (Pro-Taper) compared to single-file reciprocating systems (Reciproc or WaveOne) ( $P < 0.05$ ). These results agree with previous studies that showed better debris and smear layer removal after irrigant agitation with EA. □ **Uses.**

Used when mechanical or hand debridement is not enough or could not do the greatest job. Also works on upgrading the effect of 5.25% sodium hypochlorite to 7.25%. Gives better results than the typical debridement in all the cases. Contraindications have not been discovered yet.

### Mechanism

1. Prepare canal to produce a fully tapered shape.
2. Fill pulp chamber with NaOCl, EDTA, or other final rinse solution.
3. Select the Activator tip that manually fits loosely within 2 mm of working length.
4. Place the barrier sleeve over the Driver to protect the entire handpiece.
5. Attach the Activator tip over the barrier-protected Driver. The Activator should snap on firmly, promoting a secure connection with the handpiece Driver.
6. Place the attached Activator tip into the prepared root canal.
7. Depress the ON/OFF switch to activate. Note: Switch defaults to high speed upon activation. Depress the 3-speed switch to select medium speed or low speed.
8. Use a pumping action to move the handpiece Driver/Activator in short 2-3 mm vertical strokes.
9. Hydrodynamically agitate the intracanal solution for 30-60 seconds.
10. Irrigate, then use intracanal suction to eliminate loose debris

### Alternatives

Endo-activation can be pursued in other ways found, the system of heating the NaOCL is one very effective endo-activation method where the sodium hypochlorite is put in a heater. This method can help from increasing the concentration from 5.25% to 7.25% with maintaining the toxicity which helps in increasing the efficiency, helps the irrigant reach parts where it cannot usually reach, and helps in the removal of a thicker layer.

### FKG System

The shape of its Xp-Endo Shaper is very effective in terms of gentle cleaning and shaping and can also work as an endo-activator due to the curvature that covers all the areas of the canal and can reach out to several areas that may be hard to reach. The shape helps in adaptation to the canals and shape memory which can be very effective in removal of most debris found and making pathways for irrigants to reach.

### Results

When comparing the amount of debris removal by normal cleaning and disinfection and the use of Endo-activation, it was proven that the percentage of debris removal was significantly higher. Added to this, the disinfection rate is better with the use of EA, as the ultrasonic polymer heads help

in increasing the efficiency of disinfection by heating the NaOCL with the vibration.

### Tailpiece

This new system has been proven very effective and optimum for having the perfect disinfection and cleaning of the root canals from debris, smear layer and other hard to reach areas with necrotic tissues and other remnants that can support bacterial regrowth and post-treatment complications. It is a huge step in Endodontic treatment and therapists should acknowledge the growth of this system as dentistry improves in a very fast pace.

### References:

1. Mahmoud Torabinejad, Richard E. Waltron, Ashraf F. Fouad: Endodontics (Principles and practice) fifth edition.
2. Brännström M, Johnson G. Effects of various conditioners and cleaning agents on prepared dentin surfaces: A scanning electron microscopic investigation. *J Prosthet Dent* 1974; 31:422-430.
3. McComb D, Smith DC. A preliminary scanning electronmicroscopic study of root canals after endodontic procedures. *J Endod* 1975; 7:238-242.
4. Pashely DH. Smear layer: Physiological considerations. *Operative Dent Suppl* 1984; 3:13-29.
5. Mader CL, Baumgärtner JC, Peters DD. Scanning electron microscopic investigation of the smeared layer on root canal walls. *J Endod* 1984; 10:477-483