Supplementary approaches in endodontic retreatment

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Abstract

Introduction: The proper cleaning and reshaping of the root canal space is of great importance for the good outcome of the retreatment case. None of the different methods and instruments used for filling material removal during endodontic retreatment exhibit 100% effectiveness. **Aim:** The aim of the current review article is to observe the contemporary supplementary approaches used in endodontic retreatment. **Materials and Methods:** Articles within the last 10 years were reviewed in light of the most commonly used supplementary techniques. **Conclusion:** Supplementary approaches show sophisticated results in filling remnants removal which leads to a better outcome of the endodontic retreatment cases.

Keywords: Endodontic retreatment, Supplementary techniques, lasers

Introduction

Orthograde retreatment is considered the first option in case of a failed primary endodontic treatment. The procedure includes removal of the old filling material and secondary shaping and disinfection of the root canals for achieving better conditions for hermetic root canal sealing and enabling the tooth preservation. (1).

Different retreatment techniques are described in the literature. Nickel-titanium (NiTi) rotary instruments are preferably used in these cases due to their superelasticity and flexibility (2). Systems, specifically developed for endodontic retreatment, like Mtwo Retreatment (VDW, Munich, Germany), D-Race (FKG, La Chaux de Fonds, Switzerland), Protaper Universal Retreatment (Dentsply, Ballaigues, Switzerland), R Endo (Micro-Mega, Besancon, France), etc., have been introduced to the market. They improve significantly the filling material removal from the root canal walls, compared to the manual instruments (3,4). Similar effectiveness was registered in experiments with conventional NiTi instruments driven by continuous or reciprocating rotation (5,6).

The complex anatomy of the endodontic system is one of the main factors that influence the positive outcome of the retreatment procedure. Most experimental investigations, concerning endodontic retreatment, are focused on teeth with oval-shaped root canals. Because of the non-adaptive core of the standard NiTi instruments and their ability to move in the center of the canal, a large area of the oval-shaped canals remains untouched from the files (7,8). The up-to-date literature states that the clean root canal surface following orthograde retreatment procedures is not more than 40% and thus, additional cleaning of the canal walls is required (9, 10, 11).

Review Results

The recently developed systems XP-Endo Finisher and the specifically designed for retreatment XP-Endo Finisher R are stated to have favorable effect as additional cleaning instruments after the bulk material has been initially removed.

XP-Endo Finisher and XP-Endo Finisher R (FKG Dentaire, La Chaux de Fonds, Switzerland) are novel instruments made of superelastic, NiTi MaxWire (Martensite-Austenite Electropolish Flex alloy). The flexibility of the instruments is a result of the heating of the alloy during the manufacturing process. These files acquire a "spoon-like" shape, 10 mm of the tip due to their martensite-austenite transformation when exposed to body temperature. The acquired shape allows the instrument to reach the anatomical irregularities of the root canal that are inaccessible for the conventional NiTi instruments. Both XP-Endo Finisher (size 25) and XP-Endo Finisher R (size 30) instruments have a taper close to zero (.01 taper in M-phase and .04 taper in Austenitic phase) (11).

Current studies demonstrate that XP-Endo Finisher and XP-Endo Finisher R enhance the cleaning of the root canal walls from debris and/or filling materials (10,12,13,14). Crozeta et al. applied in their study XP-Endo Finisher R and an ultrasonic tip as supplementary steps in the retreatment of oval-shaped canals filled with Gutta-percha and two different types of sealers (AH Plus or BC Sealer). They compared the efficacy of the two techniques in the removal of the root filling materials and concluded that the ultrasonic tip is equally effective in removing both types of sealers, while XP-Endo Finisher R removes AH Plus sealer better than BC Sealer (15). On the other hand, H.Aksel et al. reported that XP-Endo Finisher significantly improves the removal of root filling, regardless of the sealer used (16). XP-Endo Finisher R is documented to have superior cleaning ability than solvents (17) and ultrasonic and sonic techniques (18).

Self-Adjusting file (SAF), passive ultrasonic irrigation (PUI), ultrasonic tips, sonic devices, etc. have been investigated for their effectiveness as supplementary methods in removing filling materials.

The Self-Adjusting file system (ReDent, Ra'anana, Israel) tested by Abramovitz et al. demonstrated satisfying results in the cleaning of root canal walls from the residue after the use of ProTaper Universal Retreatment (9). This is in accordance with another study in which SAF was used in combination with the ProFile system (19). Yürüker et al. came to the opposite conclusion. They found that the use of SAF as an

additional instrument did not significantly improve the removal of the filling material compared to the single use of ProTaper Universal Retreatment (20).

Passive ultrasonic irrigation or ultrasonic-assisted irrigation (UAI) are originally developed to clean the smear layer from the root canals. Their action is due to the acoustic streaming and cavitation caused by the vibration of an ultrasonic tip inserted 2 mm shorter than the working length (WL) at a frequency of 30 kHz. (18). Reports in literature state that PUI improves the cleaning of filling remnants when used after the mechanical instrumentation of the root canal (21,22,23).

Ultrasonic tips, especially those designed for supplementary cleaning of oval-shaped canals during retreatment, have been recently examined (24). They tend to improve significantly the removal of filling remnants after the bulk of the material has been removed. Some of the investigated ultrasonic tips proved to be appropriate for cleaning of BC Sealers (15).

Lasers were first introduced in 1959 and since then, they have been used in many aspects of the contemporary dentistry. In the field of endodontics they are applied for root canal debridement and disinfection (25,26). Nd:YAG laser and Er:YAG lasers have been recently tested for root filling removal, relying on the thermal effect of the lasers' irradiation (27).

Nd:YAG laser is reported to remove filling materials effectively but with substantial rise of the temperature in the surrounding tissues, including blockage of the dentin tubules by melted dentin and carbonization. Vidučić D. et al. concluded that Nd:YAG laser is capable of softening gutta-percha. Due to the temperature increase they suggested the use of lower energy parameters and shorter periods of lasing for preserving the periodontal ligament (28). Carbonization disturbs the connection between the new obturation material and the dentin in the root canal, thus worsening the prognosis of the retreatment case (29). Lately, a newly-developed fiber-optic system of Nd:YAG enables the laser use even in narrow root canals (28).

Er:YAG laser is preferred for its lower thermal effect on the tooth structures and the surrounding periodontium and its lower thermal trauma compared to Nd:YAG laser (26). In a current study of Tachinami and Katsuumi three different energy output levels of the Er:YAG irradiation were tested and it was concluded that the 40 mJ energy output is the optimal parameter for gutta-percha removal.

Conclusion

Supplementary approaches have been investigated to improve the root canal cleaning after the use of rotary instruments and have shown sophisticated results. Innovative NiTi instruments, ultrasonic tips designed for retreatment or activation of the endodontic solutions have been studied and all of them improved the removal of the root filling materials. Lasers have been recently promoted in the field of endodontic retreatment. Development of new additional approaches need to be further investigated to facilitate the prognosis of the endodontic retreatment and relieve daily dental practice.

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