Root canal cleanliness after preparation with three different Nickel Titanium Rotary Systems

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INTRODUCTION

Successful root canal treatment depends primary on removal of microorganisms through chemo-mechanical instrumentation of root canal system. While root canal shape can be predictably and efficiently obtained, efficient cleaning of the entire root canal system remains a challenge.

All endodontic instruments create dentine debris and a smear layer as a consequence of their action on root canal walls. Debris may be compacted along the entire surface of canal walls, increasing the risk for bacteria ‘contamination’ and reducing the adaptation of sealer and gutta-percha Furthermore, these debris may be compacted apically and create an apical plug that prevents the complete filling of this important region. Smear layer needs to be removed or retained before obturation is a controversial topic. Smear layer contributes to leakage and is a source of nutrients for microorganisms. Smear layer removal affords, a better adaptation of obturation material. Dentin permeation by diffusion is increased by 5 to 6 times, this allows an improved penetration of disinfecting agents,medicaments. Insufficient removal of debris and smear layer material can induce stresses on the cutting segment of endodontic instruments. Smear layer production differs according to the instruments used for preparation,the way the instrument is used and the method of preparation.

Use of nickel-titanium (NiTi) alloy in endodontics has allowed the creation of newer instruments and preparation techniques that shortens the working time and lead the clinician to less iatrogenic errors such as ledging, zipping, canal transportation and apical blockage. Nickel titanium rotary instruments have proved to be superior over stainless steel instruments in term of cutting efficiency, flexibility and torsional resistance.

In recent decade, the technologies for manufacturing the nickel titanium instruments were significantly advanced. New rotary file systems with changes in the file taper, tip design, cutting edges, cross section, number of files or size of the files were done to improve their properities. HyFlex™ Controlled Memory NiTi Files (coltene). Biorace files (FKG) and Oneshape file(Micromega, Besancon, France) are examples of new trend files. These files cleaning ability is different and in this thesis it was evaluated by the presence of dentin debris and smear layer on canal walls.

LITERATURE REVIEW

Mandel et al[1] investigated the morphological characteristics of the smeared layer on the walls of root canals that had been instrumented with K-type files and irrigated with a 5.25% solution of NaOCl.The smeared material was examined from two perspectives. First, the scanning electron microscope was used to "look down onto" the smeared layer covering the canal wall. Second, the smeared material was looked at from the side or profile view. This was done by using the scanning electron microscope to scan the junction between the fractured dentinal tubules and the surface of the canal wall. The smeared material was found to consist of two confluent components; the smeared layer on the surface of the canal wall and the smeared material which had been packed into some of the dentinal tubules. The smeared layer on the canal wall was typically about 1- to 2-μm thick. The depth of the tubular packing varied from a few micrometers up to 40 μm.

Prati et al[2] evaluated the morphology of the smear layer and the amount of debris and pulpal residues in the apical third of human extracted straight teeth from 55- to 75-yr-old patients using Four manual endodontic instruments, an ultrasonic and an endosonic system. The manual instruments were K files, Ergoflex files used with the step-back technique, Canal Master with its own

technique, and Flex-R with the Roane technique. The ultrasonic system was Suprasson Piezo and the endosonic was Excalibur. Human extracted teeth with straight canals were used and examined under a scanning electron microscope. All manual instrumentations showed a homogeneous compact smear layer and no pulp residues. No statistical differences were observed among the four manual techniques. Ultrasonic technique showed the complete removal of the smear layer, leaving small amounts of pulp debris at the apical third, while the Excalibur showed an almost complete elimination of the smear layer, leaving a homogeneous layer of pulpal residues along the canal.

Schädle et al[3] evaluated the cleaning ability of different root canal cleaning instruments including hand-instruments, sonic instruments (Sonic Air 3000 and Endostar 5), mechanical instruments (Canalfinder System), and ultrasonic instruments (Cavi-Endo with or without integrated rinsing). 6 groups of teeth were instrumented according to the manufacturer's instructions. canals examined in a SEM at 60 selected points to assess smear layer, dentin chips, cellular remnants, and canal smoothness. Results, no instrument was able to produce debris free specimens all have the similar score.

Wu et al[4] evaluated the efficacy of three techniques in cleaning the apical portion of curved root. One hundred thirty-five mesiobuccal canals with an average curvature of 25 degrees from

human mandibular molars were treated with step-back, crown-down pressureless, or balanced-force techniques with 2% sodium hypochlorite used as an irrigant. The cleaning efficacy of these techniques was evaluated by counting the remaining surface debris under a stereomicroscope with a calibrated eyepiece micrometer. The results indicated that the apical portion of the canal was less clean than the middle and coronal portions regardless of the technique performed and that the balanced-force technique produced a cleaner apical portion of the canal than did the other techniques studied.

Heard and Walton [5] assessed the effectiveness of four preparation methods for cleaning small, curved root canals, using backscattered-imaging scanning electron microscopy (SEM). The methods were: (i) step-back without initial coronal flaring; (ii) step-back with coronal flaring; (iii) step-back with initial coronal flaring and finished by ultrasonic irrigation; and (iv) ultrasonics only. Eighty freshly extracted maxillary and mandibular molars were randomly placed into four treatment groups of 20 teeth each. After preparation, roots were sectioned longitudinally and examined wet by SEM. Each canal was qualitatively evaluated and the groups compared for removal of debris and smear layer, both overall and at each level (apical, middle and coronal). There were no statistically significant differences between the techniques, either overall or within any of the regions. When