Efficacy of Ultrasonic Vibration in Retrieving Broken Endodontic Instruments and its Effect on the Root Canal Remaining Dentin Thickness.

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بِسْـــمِ اللَّهِ الرَّحـْمَنِ الرَّحِيـــمِ

وَقُل رَّبِّ زِدْنِي عِلْمًا

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(طه 114)

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One of the most important and critical criteria in achieving successful root canal treatment is the optimal Cleaning and shaping. During root canal enlargement a number of procedural errors may occur that may hinder optimal cleaning and shaping among which are perforation, ledges, canal transportation and separated instruments. Root canal enlarging instruments are subjected to different types of stresses during instrumentation. These stresses are affected by the topography of the root canal, clinician maneuver during preparation and the type of instrument used. These factors can cause detrimental effect on the tooth and on the enlarging instrument.

An instrument will fracture if its ultimate strength is exceeded, or if a crack has extended to such a degree that the remaining intact cross-section of material is unable to bear the operating load. Instrument fracture hinders the clinician from optimal preparation.

Retrieval of separated instruments is governed by different factors among which are the type of enlarging instrument, root canal curvature, the level of fracture, the available armamentarium and the clinician experience. Different retrieval systems are present on the market with variable levels of

efficiency. The use of ultrasonics combined with dental operating microscope is considered one of the most popular methods for retrieval of separated instruments. However successful retrieval of separated instruments should be done without weakening of the root canal giving much attention to the remaining dentin thickness.

Incidence of Instrument Separation

The incidence of instrument separation has been the focus of several studies. All types of enlarging instruments either hand or rotary together with different geometrical designs have been tested.

Ramirez-Salomon et al.[1] evaluated the incidence of fracture of lightspeed instruments. One hundred sixty-two root canals in 52 maxillary and mandibular first molars were cleaned and shaped with Lightspeed instruments by three endodontists in their private practices. The canals were instrumented using the technique recommended by the manufacturer. All canals were instrumented to at least size 45 at the working length. Results showed that six instruments separated during treatment. All separated instruments were used more times than recommended by the manufacturer. Five of the six separated instruments were easily bypassed and treatment was completed.

Zuolo and Walton[2] examined wear and separation of different Ni-Ti hand and rotary instruments and hand stainless steel files. Sixty files (12/group) were used repeatedly in curved

canals until failure or for a maximum of 22 minutes. Instruments were examined with scanning electron microscopy both new (control) and at spaced intervals for evidence of wear and fatigue. Results showed that Stainless steel instruments tended to wear the most rapidly, and next were nickel-titanium rotary instruments. The most resistant to wear were nickel-titanium hand instruments. As for instrument separation hand nickel-titanium instruments resisted deterioration better than did stainless steel. Nickel-titanium rotary instruments (2 of 12) had the highest percentage of separation.

Patiño et al.[3] evaluated the rate of separation of rotary Nickel titanium files with or without manual glide path. Two hundred and eight canals were instrumented using three different systems namely K3, ProFile and ProTaper. In all three groups the apical portion of the samples was prepared with size 10-20 stainless steel K-type hand files. The apical stops were prepared using K3, ProFile and ProTaper rotary instruments. Results showed that file separation was highly linked to the angle of curvature of the canal and the number of uses of the file (files used more than eight times broke more frequently that those used 1 or 2 times). Furthermore, the attempt to do glide path prior to canal enlargement decreased the rate of instrument fracture. The

authors thus suggested the preparation of the apical third of the canals with manual file before using rotary nickel titanium files.

Knowles et al.[4] conducted a clinical study to evaluate the rate of lightspeed instrument separation in a clinical practice. A total of 3543 canals were treated over a 24 month period. The results showed that the rate of instrument separation was 46 instruments (1.3%). This incidence rate of fracture was considered to be lower than previous studies.

Iqbal et al.[5] followed the rate of instrument separation among cases done by graduates of endodontic program. Four thousand eight hundred and sixty five cases were followed and the incidence of instrument separation was recorded. Results showed that the rates of instrument separation of hand and rotary files were 0.25% and 1.68%, respectively. According to the authors results rotary files broke seven times more than manual files. Most instrument separations occurred in the apical third of the canals (6 times more than coronal and middle). The highest percentage of separation occurred in mandibular (55.5%) and maxillary (33.3%) molars. Files separated 2.9 times more in molars than premolars. Among the ProFile series 29 rotary instruments, the .06 taper #5 and #6 files separated the most. Furthermore, there was no significant difference in instrument