بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

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MONA MAGHRABY

Temperature-Dependent Cyclic Fatigue Resistance and Differential Scanning Calorimetry Analysis of Three Rotary Nickel Titanium Instruments

Thesis Submitted to the Faculty of Dentistry, Ain Shams University, in Partial Fulfillment of the Requirements of Master's degree in Endodontics

Submitted by

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بسم الله الرحمن الرحيم

{قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا
مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ}

(سورة البقرة: الآية 32)

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Dedication

This work is dedicated to….

My beloved parents, brother and sister who have been a constant source of emotional and moral support in every aspect of life.

My husband who has always been there to support and encourage me, providing every possible help at all times, this thesis would certainly not have existed without him.

My daughter who has always been the joy of my life.

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Root canal cleaning and shaping are important phases in endodontic treatment. The criteria of canal preparation includes; removal of all the canal content, developing continuously tapering preparation in a conical form and maintaining the apical foramen in its original position. However in curved root canals, transportation of apical foramen, ledge formation, and non-tapered hourglass shaped preparation are problems frequently observed after instrumentation. To overcome these problems, nickel-titanium (NiTi) rotary instruments have been developed.

The mechanical features of NiTi files grant the flexibility to the files, and provide convenience in preparation of curved canals. Despite this advantage and all the conveniences that NiTi files offer, the most important disadvantage is that they can unexpectedly fracture. These fractures occur as a result of torsional or cyclic fatigue (CF). The CF fractures occur as a result of the repetitive compression and tension stresses that the file is exposed to within the curved canals. On the other hand, the torsional fractures occur as a result of the continuance of rotation of coronal part of the file, while the tip or a part of file is stuck in the canal.

Thermomechanical processing and heat treatment are the most fundamental methods to control the transition temperature of the NiTi files that improve the flexibility and the fatigue resistance of the NiTi instruments. First M-Wire was introduced then R-phase and later so-called controlled memory (CM) Wire. More recently, Blue and

Gold alloys have appeared, named for blue/gold-colored layer that results from the oxidation that the proprietary heating and cooling processes induce in the surface of the instrument. These new, more martensitic alloys have shown better fatigue behavior.

The manufacturing method is also known to influence the CF resistance of shaping rotary instruments; for example, rotary instruments manufactured by electrical discharge machining (EDM) showed higher fatigue resistance over those made via grinding and shape setting[1].

CF resistance has traditionally been tested at room temperature; however, newer alloys present transformation temperatures much higher than those of conventional austenitic materials that may in fact transform close to body temperature[2]. Recent studies have shown different fatigue behavior of rotary instruments when tested at different temperature[3].

Differential Scanning Calorimetry (DSC) provides method through heating and cooling NiTi instruments where the points at which the austenite to martensite (or reverse) phase transition begin and end. As a result, a prediction can be made as to which phase(s) a NiTi alloy will be present at the given temperature.

HyFlex EDM files are NiTi rotary instrument manufactured from CM wire by using EDM technology. M3 pro Gold files and Soco pro files are newly released; according to the manufacturer both the CF resistance and the flexibility are improved. To date, there is no study comparing the CF resistance of these new files.

I-Cyclic Fatigue:

1) Modes of NiTi instruments separation:

Many studies have been made to understand causes of NiTi files separation and propose solutions to overcome this problem[4,5]**.** Cyclic and/or torsional fatigues are the main mechanisms that may lead to instrument separation[6,7]. During root canal shaping procedures, part of the instrument binds to the dentin, and the rest of the file continues to rotate, resulting in torsional fatigue[6]. This type of fracture is usually accompanied by some sort of plastic deformation of the instrument[8]. Many studies and techniques have been done to control and minimize torsional breakage of endodontic NiTi instruments e.g: creation of glide path, gradual enlargement of canals, use of lubrication during preparation, varying instrument pitch, varying instrument taper, use of low torque endodontic motor, use of torque controlled endodontic motor, use of reciprocating endodontic motors and designing reciprocation motions with angles less than the elastic limit of the instruments used. When the instrument rotates in a curvature, it generates tension/compression cycles in the