Cutting Efficiency as Correlated with Design Feature Measurements of Three Different Rotary Root Canal Instruments. In-Vitro Study.

Thesis

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By

Mohamed Medhat Kataia, B.D.S

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Supervisors

Professor Dr Salsabyl Mohamed Ibrahim

Professor of Endodontics, Endodontic Department

Faculty of Oral and Dental Medicine,

Cairo University

Professor Dr Eman El Mahalawy

Professor of Engineering, Mechanics Department

Faculty of Engineering,
Cairo University

Assistant Prof Dr. Ghada EL-Hilaly Eid

Assistant Professor of Endodontics, Endodontic Department

Faculty of Oral and Dental Medicine

Cairo University

MAY GOD BLESS MY MOTHER, FATHER AND SISTER

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DEDICATION

To the devoted and forever-caring Father and Mother; they after GOD gave me the world I needed.

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Introduction

Shaping and cleaning of the root canal system and the elimination of all debris before obturation are the most important requirements to improve the quality of root canal preparation, which lead to better obturation, apical seal, and eventually to better prognosis for the treated tooth. This step has been done using hand instruments which has been time consuming and tedious.

The idea of inventing an engine driven root canal shaping and cleaning instrument has been the dominating concept of all scientist's minds in the late decades. Rotational root canal drills have been in constant modification in the design feature and the metallurgical aspects for years. This constant modification has given the experience that the innovational nickel titanium material has been superior when it comes to the mechanical properties, which are needed in the drilling process during the endodontic treatment. Tremendous advances in the design of these instruments definitely did improve their cutting efficiency.

Newer generations are introduced to the market with specific design features such as variable taper, absence of helical angles and flutes and the changes in cross section design. Understanding of the manufactured geometrical design and correlate the specific design of the instrument in cutting and shaping root canal to improve their clinical performance is important.

Review of Literature

I. Invention of conventional root canal instruments;

Through the years multiple instruments have been used to instrument within the root canals, remove of pulp tissue, and preparation of the root canal to receive the obturating material.

At first, the painful tooth that was not mobile and not decayed was to be cauterized [(1)] (i.e.) the teeth were not to be prepared, but afterwards root canal preparation and the insertion of pivot posts and crowning the teeth took place.

After years of relative inactivity, a remarkable upsurge in the endodontic instrument design and refinement was developed. Historically, very little was done to improve the quality or standardization of instruments until the 1950s, when two research groups started reporting on the sizing, strength, and materials that went into hand instruments [(2)].

By 1962, a working committee on standardization had been formed including manufacturers, the American Association of Endodontists (AAE), and the American Dental Association (ADA). This group evolved into the present-day International Standards Organization (ISO). It was not until 1976, however, that the first approved specification for root canal instruments was published (ADA Specification No. 28), 18 years after Ingle and Levine first proposed standardization in 1958 [(2)].

Development of rotary instrumentation was developed to decrease instrumentation time and simplify the procedure. The first use of rotary devices was described by which fine rectangular needles were inserted passively into the canal and rotation was started once the apical foramen was reached, thin needles were used in curved canals [3]. He developed the first endodontic hand-piece for engine driven root canal preparation. By using specially designed needles on a 360^0 rotational hand-piece, he prepared the canal. Austrian company (W&H in 1928) developed cursor filing contra angle, a contra with a combined rotational and vertical motion. In 1958 an endodontic racer hand piece was developed using a vertical stroke motion then again in 1964 the Giromatic hand-piece was developed to overcome the inflexibility of conventional endodontic hand instrument, it transformed the continuous rotation of the hand piece into alternating quarter movement.

Modification of the endodontic hand-pieces was modified by the introduction of the canal finder system, which was reported to facilitate the penetration of severely curved and constricted canals without perforation and ledging [4].

Continuous development in endodontic hand pieces continued until this time were an electric hand piece with gear reduction and torque control producing a constant steady speed was utilized for all rotary nickel-titanium systems. [5]

Walia etal [6] were the first to use a nickel titanium file in the Endodontic field. Nickel-titanium for use in endodontic instrumentation was introduced as a more flexible alternative to stainless steel. This innovative discovery helped in the improvement of the quality of shaping and cleaning phase of the root canals by accommodating the special morphology and root canal environment.