Comparison of two instrumentation techniques on stress distribution and fracture susceptibility of curved root canals
(Finite element study)

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By

Mohamed Hisham Kamal Taha

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(Faculty of dentistry, Ain Shams University,2003)

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Supervisors

Prof.Dr.Salma Hassan Elashry
Professor of endodontics
Endodontic department,
Faculty of dentistry, Ain Shams University

Dr.Shehab Eldeen M.Saber
Lecturer of endodontics
Faculty of dentistry, Ain Shams University

أعوذ بالله من الشيطان الرجيم

قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا
عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

سورة البقرة – الاية ٣٢

Dedication

To my Lovely Mother

(For her spiritual support, may Allah bless her in his heaven)

To my Dearest Father

To my sweet Sisters

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Root fracture is an important clinical problem leading to extraction or root amputation. It has been observed clinically that root fracture occurs commonly in endodontically treated teeth. Endodontic procedures have been blamed as a frequent cause of root fracture. Numerous experimental studies have challenged this conclusion.

Although root fracture of endodontic origin is an infrequent event, the consequent tooth loss makes it a significant clinical concern. Factors predisposing to root fracture have been investigated using a variety of experimental approaches and are now reasonably well understood .Whilst many variables are outside the control of the clinician (natural root morphology, canal shape and size, dentine thickness), other factors can be addressed during treatment to reduce fracture susceptibility. These factors include final canal shape, extent of canal enlargement, and elimination of irregularities that serve as sites of stress concentration.

Dentin of endodontically treated teeth does not exhibit mechanical properties that are significantly different from those of vital teeth. It has been shown that access cavity preparation has non-significant effects on tooth stiffness. The load generated during lateral condensation is generally far lower than the load required to fracture the roots. Thus, obturation should not be regarded as a major cause of root fracture except in very weak roots.

On the other hand, Cleaning and shaping involves dentin removal which might compromise the fracture strength of the prepared roots.

The introduction of rotary nickel-titanium (Ni-Ti) instruments for canal preparation has changed canal shape, size, and taper compared to hand instrumentation. Canal shape after preparation with hand files can be quite irregular .From a fracture

mechanics point of view, the presence of structural defects, cracks, or canal irregularities is likely to play a major role in determining fracture resistance. With rotary NiTi preparation, canal shapes are more likely to be rounder and smoother.

Experimental fracture studies using extracted teeth are plagued by a wide variability within groups, which makes it difficult to demonstrate statistically significant effects of treatment procedures. On the other hand, numerical methods such as finite element analysis offer considerable advantages in the systematic investigation of experimental variable.

Carefully constructed models can provide valuable insights into patterns and mechanisms of clinical failure.

Therefore conducting a study for comparison of two instrumentation techniques on stress distribution and fracture susceptibility of curved root canals was thought to be of value.