Perception of Endodontist /General dentists on Etiologies of file fracture associated with different types of rotary file systems. –A Questionnaire based cross sectional study

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Abstract

Background: File fractures are a common complication in endodontic procedures, leading to increased treatment time and potential treatment failure. Understanding the etiologies of file fractures is crucial for developing effective prevention strategies.
Objective: This study aimed to investigate the various factors contributing to file fractures, with a particular focus on TruNatomy file systems. The study compared the perceptions of endodontists and general dentists regarding the etiologies of file fractures and analyzed the factors associated with different types of rotary file systems.
Methods: A non-probability convenience sampling of 2000 patients undergoing root canal treatment on mandibular first molars was conducted. Endodontists and general dentists (n=100 each) evaluated 10 cases using their standard NiTi system and TruNatomy file systems. Data was collected through online questionnaires and analyzed using parametric and non-parametric tests.
Results: The study identified excessive pressure, over-usage of instruments, complex root canal anatomy, and incorrect insertion angles as common etiologies of file fractures. TruNatomy file systems were consistently associated with a higher risk of fracture due to excessive pressure and over-usage. Other file systems also exhibited varying levels of risk associated with specific factors.
Conclusion: This study highlights the importance of preventive measures, including careful instrument selection, proper technique, and ongoing education, to reduce the risk of file fractures in endodontic procedures.

INTRODUCTION

In the realm of dental practice, endodontics garners significant interest. Root canal treatment stands out as one of the most intricate procedures, where success depends largely on the meticulous shaping and cleaning of the root canal. The primary objective is to achieve a smoothly tapered canal that closely mimics the original shape while preserving the integrity of the apical foramen.[1] Therefore, it is imperative for practitioners to be well-versed in the various techniques, systems, and instruments employed in root canal treatments[2,3].

File fractures are a common complication in endodontic procedures, leading to increased treatment time, patient discomfort, and potential treatment failure. Understanding the etiologies of file fractures is crucial for developing effective prevention strategies and improving clinical outcomes[4,5].

This study aimed to investigate the various factors contributing to file fractures, with a particular focus on TruNatomy file systems. By analyzing the responses of endodontists and general dentists regarding the etiologies of file fractures, this study sought to identify the most common causes and compare the perceptions of different groups of clinicians.

The study also compared the etiologies of file fractures associated with different types of rotary file systems, providing insights into the potential role of instrument design and properties in fracture risk.

By understanding the factors that contribute to file fractures, this study can inform best practices for preventing this complication and improving the overall success of endodontic treatments.

1. METHODOLOGY

Study Design: The study involves 2000 patients. Non-probability-convenience sampling is done for evaluation. Only mandibular 1st molar which required root canal treatment is included in the study. NiTi Rotary file system working on continuous rotation motion is selected.

Total no. of specialist practitioners: 100

Total no. of general practitioners: 100

Total no. of samples: 2000

Each practitioner has 10 cases of mandibular 1st molar which required root canal treatment. Five cases from rotary system they use in day-to-day practice and five cases of TruNatomy (Dentsply Sirona) system provided by surveyor.

Methodology

Pre-operative Procedure:

1. Complete medical/dental history
2. Standardized intra-oral radiographs (IOPA).

Intra-operative Procedure:

1. The procedure commences with rinsing oral cavity using 0.2% chlorhexidine solution (Hexidine, ICPA Health Products Ltd., India)
2. Following administration of local anesthetic solution with a 2% lidocaine with 1:100,000 adrenaline
3. Isolation is achieved by placement of sterilized rubber dam soaked in 2% chlorhexidine to prevent contamination
4. Access cavity preparation is done using appropriate access cavity preparation burs with a high-speed handpiece under copious water spray
5. Chemo-mechanical preparation is done using NiTi rotary file system with Endomotor according to manufacturer's instructions
6. Irrigation is done using irrigating solution following the proper irrigation protocol

Post-operative Procedures:

1. Post-operative instructions are given to patients and patient is asked to follow the prescribed medication protocol
2. A Survey questionnaire is filled by Practitioner post root canal treatment for the Rotary Niti used in daily practice and Trunatomy respectively

Information is collected from each practitioner to gain insight into the experiences and beliefs of general and specialist practitioners concerning the new endodontic technology of rotary NiTi instrumentation based on their clinical experience with the rotary systems. Following questionnaire is distributed to all the study participants.

Statistical Analysis

Statistical Analysis was performed with help of Epi Info (TM) 7.2.2.2 EPI INFO is a trademark of the Centers for Disease Control and Prevention (CDC).

RESULTS

Table 1 shows responses for various etiologies of file fracture in different types of Rotary File Systems by Endodontist. The mean score for excessive pressure as a cause of file fracture (Q1) is highest for Trunatomy file systems (4.76 ±0.43) and lowest for Protaper (universal and next) file systems (2.67± 0.52). The mean score for over-usage of instruments as a cause of file fracture (Q2) is highest for Trunatomy file systems (4.65±0.48) and lowest for 2shape, 2shapemini file systems (2.88± 0.35). The mean score for complex root canal anatomy as a cause of file fracture (Q3) is highest for Trunatomy file systems (3.43±0.52) and lowest for Onecurve file systems (1.20± 0.45). The mean score for unknown etiology of file fracture (Q4) is highest for Trunatomy file systems (2.67±0.47) and lowest for Protaper (universal and next) file systems (1.00± 0.00), 2shape, 2shapemini file systems (1.00± 0.00), and Onecurve file systems (1.00± 0.00). The mean score for incorrect insertion angle of file as a cause of file fracture (Q5) is highest for Trunatomy file systems (2.67±0.47) and lowest for Protaper (universal and next) file systems (1.00± 0.00), 2shape, 2shapemini file systems (1.00± 0.00), and Onecurve file systems (1.00± 0.00). Thus, the most common etiology for file fracture in Trunatomy file system is application of excessive pressure,for Protaper file systems (gold and ultimate) are over-usage of instruments and incorrect insertion angle of file,for Protaper file systems (universal and next) is over-usage of instruments, for Hyflex CM, Hyflex EDM file systems is overusage of instruments, for 2shape, 2shapemini file systems is-incorrect insertion angle of file, for all types of NeoEndo file systems is over-usage of instruments,

for Mtwo file system is over-usage of instruments, for Onecurve file system is over-usage of instruments, for Endostar, Edge-taper, Edgefile X7 file systems is over-usage of instruments, for Woodpecker heat treated file systems are excessive pressure, over-usage of instruments, and incorrect insertion angle of file.

Table 2 shows responses for various etiologies of file fracture in different types of Rotary File Systems by General Dentist. The mean score for excessive pressure as a cause of file fracture (Q1) is highest for Trunatomy file systems (4.11±0.60) and lowest for Protaper (gold and ultimate) file systems (2.78±0.667). The mean score for over-usage of instruments as a cause of file fracture (Q2) is highest for Protaper (universal and next) file systems (4.00 ±0.000) and lowest for Hyflex CM, Hyflex EDM file systems (3.00±0.000), Protaper file systems (gold and ultimate) (3.00 ±0.500) and Onecurve file system (3.00±0.001). The mean score for complex root canal anatomy as a cause of file fracture (Q3) is highest for Trunatomy file systems (3.06 ±0.42) and lowest for Onecurve file systems (1.00±0.001). The mean score for unknown etiology of file fracture (Q4) is highest for Endostar, Edge-taper, Edgefile X7 file systems (2.18±0.405) and lowest for Onecurve file systems (1.00±0.001), 2shape, 2shapemini file systems (1.00± 0.00), and Onecurve file systems (1.00± 0.001). The mean score for incorrect insertion angle of file as a cause of file fracture (Q5) is highest for other file systems (2.67±0.47) and lowest for Onecurve file systems (1.00± 0.001).Thus, the most common etiology of file fracture in Trunatomy file system is application of excessive pressure, for Protaper file systems (gold and ultimate) are over-usage of instruments and incorrect insertion angle of file, for Protaper file systems

(universal and next) is over-usage of instruments , for Hyflex CM, Hyflex EDM file systems is excessive pressure and over-usage of instruments, for all types of NeoEndo file systems are excessive pressure and over-usage of instruments, for Onecurve file system are excessive pressure, over-usage of instruments and incorrect insertion angle of file, for Endostar, Edge-taper, Edgefile X7 file systems is over-usage of instruments, for Woodpecker heat treated file systems is over-usage of instruments, and incorrect insertion angle of file, and for other file systems is over-usage of instruments.

DISCUSSION

Endodontists vs. General Dentists: Both groups identified similar etiologies for file fractures, but the relative importance of each factor varied. Endodontists consistently rated excessive pressure and over-usage of instruments higher than general dentists, suggesting a greater awareness or experience in managing these factors[5,7,8].

Trunatomy File Systems: Across both groups, TruNatomy file systems were consistently associated with a higher risk of file fractures due to excessive pressure and over-usage of instruments. This suggests that these files might require more careful handling or have inherent characteristics that make them more prone to fracture under certain conditions.

Other File Systems: The study also revealed variations in the etiologies associated with other rotary file systems. For example, Protaper (universal and next) file systems were more prone to over-usage, while Hyflex CM, Hyflex EDM, and NeoEndo files were associated with a higher risk of excessive pressure[3,9,10].

The findings from Table 1 and Table 2 suggest that the etiology of file fractures is multifactorial and can vary depending on the specific file system used and the operator's technique. Excessive pressure and over-usage of instruments appear to be common contributors, particularly for TruNatomy file systems.

Implications for Practice:

To prevent file fractures, dentists should carefully select instruments based on root canal characteristics and their experience, use proper technique to avoid excessive pressure and ensure correct instrument usage, and participate in ongoing education and training to develop necessary skills and knowledge

Future Research:

Further research is needed to investigate the specific properties of different file systems that contribute to fracture risk. Additionally, studies on the impact of operator factors, such as experience and training, on file fracture rates would be valuable.

CONCLUSION

This study provides valuable insights into the etiologies of file fractures in endodontic procedures, particularly when using TruNatomy file systems. The findings highlight the importance of preventive measures, education, and training to reduce the risk of this complication. Excessive pressure and over-usage of instruments were identified as common contributors to file fractures, suggesting the need for careful technique and instrument selection.

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Table 1: Etiology of File Fracture in Different types of Rotary File Systems- Endodontist

ETIOLOGY	Trunatomy	Protaper gold, ultimate	Protaper universal, next	Hyflex CM, Hyflex EDM	2shape, 2shapemini	Neoendo (al files)	Mtwo	Onecurve	Endostar, Edge-taper, Edgefile X7	Woodpecker heat treated	Other files
Q1	4.76±0.43	2.86± 0.83	2.67± 0.52	2.80± 0.52	2.75± 0.46	4.00± 0.50	2.86± 0.38	2.80± 0.45	3.57± 0.53	3.50±0.71	3.07±0.47
Q2	4.65±0.48	3.09± 0.53	3.00± 0.00	3.10± 0.31	2.88± 0.35	4.33± 0.50	3.00± 0.58	3.00± 0.00	4.14± 0.38	3.50±0.71	3.50±0.65
Q3	3.43±0.52	2.14± 0.83	1.67± 0.82	1.35± 0.59	1.50± 0.53	2.89± 0.60	2.14± 0.38	1.20± 0.45	2.14± 0.90	3.00±0.00	2.07±0.62
Q4	2.67±0.47	1.27± 0.46	1.00± 0.00	1.10± 0.31	1.00± 0.00	2.00± 0.50	1.29± 0.49	1.00± 0.00	1.71± 0.49	2.50±0.71	1.43±0.51
Q5	4.51±0.73	3.09± 0.61	2.67± 0.52	2.70± 0.57	3.00± 0.00	3.67± 0.50	2.86± 0.38	2.60± 0.55	3.29± 0.76	3.50±0.71	3.00±0.39

Table 2: Etiology of File Fracture in Different types of Rotary File Systems- General Dentist

ETIOLOGY	Trunatomy	Protaper gold, ultimate	Protaper universal, next	Hyflex CM, Hyflex EDM	2shape 2shape mini	Neoendo (all files)	Mtwo	Onecurve	Endostar, Edge-taper, Edgefile X7	Woodpecker heat treated	Other files
Q1	4.11±0.60	2.78±0.667	3.83±0.753	3.00±0.000	----	3.94±0.429	----	3.00±0.001	3.45±0.522	3.25±0.463	3.83±0.446
Q2	3.89±0.53	3.00±0.500	4.00±0.000	3.00±0.000	----	3.94±0.556	----	3.00±0.001	3.82±0.405	3.63±0.518	4.00±0.506
Q3	3.06±0.42	1.89±0.601	2.83±0.408	1.63±0.744	----	2.82±0.529	----	1.00±0.001	2.45±0.522	2.25±0.463	2.80±0.564
Q4	2.14±0.35	1.33±0.500	1.33±0.516	1.00±0.000	----	2.06±0.429	----	1.00±0.001	2.18±0.405	1.75±0.463	1.93±0.526
Q5	3.19±0.73	2.89±0.601	3.50±0.548	2.88±0.354	----	3.71±0.470	----	3.00±0.001	3.55±0.522	3.00±0.000	3.70±0.464